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AMAUROTIC IDIOCY AND RELATED CONDITIONS*

PATHOLOGY OF THE RETINA IN INFANTILE AMAUROTIC IDIOCY

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INTRODUCTION

Amaurotic idiocy is a familial disease, characterized by pathological changes of the ganglion and glia cells, involving at all times the brain (idiocy), generally the retina (amaurosis), and at times other parts of the body. The degeneration of these cells may start very early in life, after a few months of apparently normal postnatal development (infantile amaurotic idiocy, Tay-Sachs), or later.

The ophthalmoscopic picture in the latter varieties of amaurotic idiocy varies, whereas it is more constant in the infantile form, showing nearly always a white oval patch resembling the color of Berlin's edema with a central red spot in the macular region (Tay's sign). Such a white patch with a central red spot has been observed in 6 of the 27 published cases of Niemann-Pick's disease, a "lipoidosis." Thus a disease regarded as degenerative is related to a disease considered as being a disorder of lipoid metabolism.

SHORT CLINICAL DESCRIPTION OF LIPOIDOSES AND AMAUROTIC IDIOCIES

LIPOIDOSES

Chemical analysis has revealed that the affected organs in these diseases, generally the spleen and liver, contain a pathologic amount of certain substances which can be extracted by organic solvents such as alcohol and ether, but which are not ordinary fats. These substances are called lipoids, the diseases lipoidoses. These diseases are classified according to the chemical structure of the lipoid found in the organs:

1. Phosphatide lipoidosis, Niemann-Pick's disease, so called since the affected cells, Pick's cells, contain lecithin, a phosphatide.
2. Cerebroside lipoidosis, Gaucher's disease, since Gaucher's cells contain kerasin, a cerebroside.
3. Cholesterin lipoidosis, Schüller-Christian's disease.

The first two affections have many characteristics in common: in Winter's case of Niemann-Pick's disease the probability of a case of Gaucher's disease in the same family was established; however, there was no autopsy, the diagnosis being based upon puncture of the spleen. Cholesterin lipoidosis is different in many respects.

Phosphatide lipoidosis (Niemann-Pick's disease) occurs, according to Baumann, chiefly in girls (22/4), in the Jewish race (19/7), but only one substantiated familial case has been published (Knox, Wahl, and Schmeisser), one of the two members showing Tay's sign. Three doubtful familial cases have been reported. The onset of the disease is very

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early, beginning possibly even in intrauterine life; death occurs between the 7th and 27th month (average 14th month).

Clinically characteristic is the enormous distension of the abdomen and the presence of a large, hard liver and spleen. Half of the patients in the reported cases had a gray-brown skin (hemochromatosis) and there were often hard lymphatic nodules present. In addition to these main features there often occurs a degeneration of the ganglion cells of the brain. This degeneration causes neurologic and psychic symptoms and signs, which Baumann has described as follows: "The child becomes quiet, the mobility lessens, it can no longer sit nor keep the head upright; the faculties of laughing, crying, recognizing its relations disappear. Finally the child lies motionless, once or twice an hour one of the legs moves slowly. There is a hypertonia of the muscles of the legs, at first with high reflexes which later vanish."

Cerebroside lipoidosis (Gaucher's disease) is a familial disease that affects the spleen, liver, lymphatic nodules, bone marrow, and the bones. It is associated with a hemochromatosis, runs a chronic course (time elapsing between diagnosis and death averaging 19.3 years), and occurs at a comparatively late age (oldest patient 56 years). In such cases the ganglion cells are not affected.

Of special interest is the infantile form of Gaucher's disease (Oberling and Woringer). This variety runs an acute course and affects the brain cells, causing hypertonia, hyperreflexia, opisthotonus, cachexia, and idiocy. As far as I know Tay's sign has not yet been reported in association with infantile Gaucher's disease, though a morphologically similar affection of the ganglion cells may underlie both (Lindau).

Cholesterin lipoidosis (Schüller-Christian's disease). The conception "cholesterin lipoidosis" is difficult to outline. According to some authors this affection is a variety of xanthomatosis, which, however, is often less generalized.

Schüller-Christian's disease is characterized by pathological bone foci, exophthalmos, and diabetes insipidus, in addition to which nodules in the skin, lymphatic nodules, swelling of the liver and spleen, and amaurosis (by lipogranulomatous changes in the fundus of the eye) have been reported. The rare cerebral variety is of special interest.

AMAUROTIC IDIOCY

Clinically the diseases described under this name differ widely, though they have certain features in common: familial occurrence, idiocy, neurological symptoms, a frequent affection of the retina or optic nerve—all of which develop in an apparently normal individual. They are divided into three or four groups, according to the age at which the affection appears:

1. Infantile amaurotic idiocy (Tay-Sachs), onset under 1 year.

2. Late infantile amaurotic idiocy (Bielschowsky), onset over 1 year.

3. Juvenile amaurotic idiocy (Stock, Spielmeyer, Vogt), onset between the ages of 6 and 14 years.

Cases from group 2 and part of group 3 are often united in the group: Familial cerebral degeneration with macular changes (Batten and Mayou, Oatman, Darier).

4. Adult cases, "Spätfälle" (Kufs), developing at middle age.

Classical *infantile amaurotic idiocy* (Tay-Sachs's disease) occurs in Jewish children under one year of age. Clinically it is characterized by progressive paralysis, convulsions, idiocy, and Tay's sign. The clinical picture is very similar in the various reported cases. Parsons and Schaffer support the view that a true amaurotic idiocy must present all of the

above-mentioned signs. It is impossible, however, to neglect or simply to exclude cases which, though they differ in some respects, must obviously be related to infantile amaurotic idiocy. The disease may occur in non-Jewish families; Tay's sign may be absent.

Tay-Sachs's disease appears in neuropathic families (Bertrand and van Bogaert). Often tuberculosis, epilepsy, and endocrine disturbances are found in relatives.

Late infantile amaurotic idiocy (Bielschowsky) resembles infantile amaurotic idiocy or juvenile cases and will be discussed when considering the eye lesion.

Juvenile amaurotic idiocy (Stock, Spielmeyer, Vogt) has long been a conception difficult to outline because of the considerable differences between the individual cases. In Sweden, where the infantile form of amaurotic idiocy does not seem to have been observed, E. Sjöval and Sjögren described 115 cases of juvenile amaurotic idiocy, one case closely resembling the other. The course of these cases is as follows: From the age of 5 to 8 years a progressive deterioration of vision develops associated with mental retrogression. As a rule this occurs in apparently normal individuals. Epileptic fits develop followed by extrapyramidal signs, the patient walks with characteristic small steps, and, finally, ataxia with extreme mental degeneration follows. Death occurs on the average at 18 years of age.

Adult amaurotic idiocy (*Kufs's* Spätfälle). In Kufs's second patient the course was as follows: After an apparently normal development, interest in school disappeared at the age of 10 years; at 16 imbecility and unsocial behavior developed, but only in the thirty-sixth year did symptoms of an organic brain process appear, which were followed in the thirty-ninth year by a rapidly progressive fatal disturbance of fat metabolism. Vision and hearing remained normal.

Recently van Bogaert and Borremans described a case in a man, 62 years old; they could differentiate this disorder from senility.

THE EYE IN LIPOIDOSES AND AMAUROTIC IDIOCY

Lipoidosis. In six cases of Niemann-Pick's disease Tay's sign was noted. In Schüller-Christian's disease a granulation tissue may develop in the eye. Redslob and Gery demonstrated Gaucher cells in the choroid (Rintelen).

The Idiocies. Classical cases of *infantile amaurotic idiocy* are especially observed in Jewish families of Russian origin (van Bogaert, Goldfeder). In these cases a white oval patch with a central red spot is always seen in the macular region (Tay's sign). It is not seldom associated with a more or less advanced optic atrophy.

But in some cases, in which the diagnosis is well established by autopsy, Tay's sign may be absent (Schlesinger, Greenfield, and Stern; Radovici, Elias, and Schachter; Evans, Mülberger, Roger, Aubaret, Reboul-Lachaux), even though there is optic atrophy. Epstein even reported the complete absence of ocular symptoms, but in this case a pathological examination was not performed, according to Bertrand and van Bogaert.

In two of Bertrand and van Bogaert's cases the macula was "grumeleux" pigmented, in one of these cases associated with atrophy of the optic nerves. This fundus picture resembles the macular lesions described by Batten and Mayou and other authors as occurring in late infantile and juvenile amaurotic idiocy. Pigmented retinal degeneration occurred in the cases of Hildesheimer and Schuster, and Macnamara, Dickson, and Hill, resembling the fundus of juvenile amau-

rotic idiocy in Sjögren's cases. Hässler and Scholz report cases of chorioretinitis as in syphilis with atrophy.

Greenfield and Nevin described a *late infantile* case with Tay's sign, but it could also be regarded as an infantile case developing at an unusually advanced age. In one of Cordes's cases also a cherry-red spot was observed (onset at 1½ years).

Recently Worster-Drought and Sorsby described a case in a child 4½ years old. The fundi showed pale optic discs with macular lesions of atrophic type; little pigmentary disturbance. The periphery of the fundus was albinotic in type and what little pigment was present was finely granulated and suggested considerable retinal atrophy.

Infantile amaurotic idiocy is characterized by Tay's sign. Greenfield and Nevin proved that typical cases may occur unusually late (at the age of two years).

In my opinion cases which clinically show pigmentary changes and anatomically an affection of the rods and cones and of the pigmentary epithelium should be considered early juvenile cases.

It is possible that a less-advanced ganglion-cell degeneration that does not produce Tay's sign may give rise to an optic atrophy. These cases are of great interest and can be classified with certainty only if the condition of the ganglion cells, the rods and cones, and the pigmented epithelium are carefully studied anatomically. Since the diagnosis of optic atrophy in young children is not reliable, the ophthalmologist should avoid giving a definite diagnosis, as this is possible in cases with macular affection. These cases are of interest for the possibility of a primary degeneration of the white matter.

Since the histological study of the eye allows a very clear separation between infantile and juvenile amaurotic idiocy, I believe the creation of an intermediary group of "late infantile cases" must be rejected. This group contains late infantile cases, early juvenile cases, and unclassified cases. Publications of additional clinical observations without an accurate anatomical report are useless.

In *juvenile amaurotic idiocy* only Torrance (according to Greenfield and Nevin), of all the writers on this subject, has reported "finding a red spot at the macula in juvenile cases." This has not been confirmed by any other author. There may be distinguished two definite varieties of ocular involvement: (1) a degeneration (chiefly) of the macular region; (2) a more generalized affection of the retina.

(1) In 1897 R. D. Batten described fine stippled pigment at the maculae with slight pallor of the optic disc in two mentally alert brothers aged 14 and 21 years. In 1903 F. E. Batten described similar changes with cerebral degeneration in two cases starting at about the age of six years. In 1904 Mayou published a report of the same disease in three members of another family, starting at the age of seven years.

Gifford (1912) and also Darier (1914) described a new case and carefully analyzed all the recorded cases. Still later (1915) Batten and Mayou reported new cases in one of which the changes in the macula were the last stage in the march of degeneration. Schall; Holmes and Paton; Landegger; and Halbertsma and Leendertz have mentioned juvenile cases of cerebromacular degeneration. The latter two authors have also reported finding peripheral anomalies with normal arteries. This group seems to be closely related to familial progressive macular degeneration (Stargardt, 1909) in which disease also peripheral anomalies occur ("the negative of pigmented retinitis").

(2) Stock in 1908 described three children of one family who became blind at

the age of six to seven years, whereas simultaneously severe mental symptoms (idiocy) developed. In two cases the fundus picture was similar to that of retinitis pigmentosa, although the discs and vessels were fairly normal. In the third case the anomalies were difficult to trace.

Rosengren has described the development of fundus changes in Sjögren's patients as follows: In early stages the disc is gray and the vessels narrow. The anomalies are bilateral and symmetric. In later stages occur groups of small round areas with indistinct borders, which at times fuse. They are of a yellow color at the periphery and are associated with a slight pigmentation and a retinitic atrophy of the disc. Less frequent are the cases in which a fundus picture develops similar to retinitis pigmentosa, from which they differ by developing in the young and by a rapid progression. In later stages the discs are a pale yellow, the typical pigmentation may cover the entire fundus, and finally a posterior cataract may develop.

In adult cases (Kufs) the ophthalmological aspect is negative, a statement which has recently been confirmed by van Bogaert.

Beside these more or less typical affections in the eye Cacchione has reported finding small spots in the cornea in three cases of late infantile amaurotic idiocy. Villani observed Fehr's degeneration of the cornea in three children of one family with amaurotic idiocy (1½, 7, and 9 years of age).

AMAUROTIC IDIOCY AND LIPOIDOSIS FROM A CLINICAL POINT OF VIEW

In the first part of this paper attention was called to the lipoidoses because of the fact that the main clinical feature of infantile amaurotic idiocy, Tay's sign, is not infrequently encountered in a lipoidosis. In the short description given, it was pointed out that whereas the lipoidoses include diseases affecting especially the liver and spleen, the idiocies are characterized by a common cerebral affection. So much for a general statement, but a similar cerebral affection has also been found in Niemann-Pick's disease and in the infantile form of Gaucher's disease. This latter is of special interest because of the age of the patients whose brains become affected, reminding one of the fact that the barrier protecting the brain is less efficient in young individuals. The presence of cerebral symptoms and signs clinically connects the lipoidoses with the amaurotic idiocies, although these symptoms and signs are not specific, since they occur in other types of cerebral disease. Moreover, the cerebral symptoms in infantile amaurotic idiocy and in Niemann-Pick's lipoidosis are not completely identical. Both diseases, according to Baumann, show idiocy, arrest of development, cachexia, akinesia, hypo- or hyperreflexia, hypo- or hypertonia, inability to hold the head upright, and occasionally choreo-athetoid movements. But none of the cases of Niemann-Pick disease show the following signs of Tay-Sachs: a well-developed hypertonia, tonic clonic extensor convulsions of the extremities, Magnus reflexes, jumpiness, hyperacusis, subnormal temperatures, constipation, increase in the size of the skull, and familial incidence. In addition, Niemann-Pick's disease develops very early whereas the Tay-Sachs form manifests itself first at about the age of six months and after an apparently normal development.

The heredity is of interest: Only in van Bogaert's case did Niemann-Pick's disease and infantile amaurotic idiocy occur in the same family. I could find but two cases in which a family relation between infantile and juvenile amaurotic idiocy seemed probable: In a family case of Higier, one child suffered from Tay-

Sachs, one from juvenile amaurotic idiocy, and two from atrophy of the optic nerve. Bertrand and van Bogaert found in the family of one of their patients with infantile amaurotic idiocy another member affected by what they strongly suspected to be juvenile amaurotic idiocy.

Pathology of amaurotic idiocy and lipoïdosis

The idiocies

Infantile amaurotic idiocy. The anatomical basis of the process is a swelling of the plasma of the ganglion cells together with the appearance of lipoid granules.

The protoplasm of the affected ganglion cells stains pink or pale orange with Sudan, the granules stain with the hematoxylin-lac method. The degeneration may affect ganglion cells in any part of the body, even the sympathetic ganglia (van Sántha, Mott, according to Treacher Collins). Van Sántha extensively described the pathology in three cases of infantile amaurotic idiocy, death occurring at 18, 22, and 29 months, respectively. He considers the swollen cell with a good nucleus as the first stage. By double staining with Weigert and Sudan stains he demonstrated that indeed these cells may be free of either Sudan or hematoxylin positive granules, consequently the appearance of lipoid is secondary to a primary cellular affection. This view is in contradiction to that of Bielschowsky, who believed that a lipoid infiltration of the cells is primary. Bielschowsky, in a case (the eyes to be described later) demonstrated Pick's cells in the heart and the Malpighian bodies of the spleen. But A. Sjövall calls attention to the fact that lipoid-containing cells can be present in a normal organism, so that only a quantitative difference is significant.

Stheeman showed that the human lymph nodules contain cells which react positively to the Sudan test (pale red) and even slightly positively to the hematoxylin-lac (Smith-Dietrich) test. A. Sjövall confirmed this finding in the normal rabbit and found similarly reacting cells in the spleen which, however, were more positive to the lac test. In the thymus and bone marrow, and even in the lungs, lac-positive granules are found. In the tubule epithelium of the kidneys granules positive to the hematoxylin-lac method occur frequently in individuals who have died from other diseases, as was first demonstrated by Kimmelstiel and Laas.

Van Sántha in reporting his second case of Tay-Sachs's disease mentions the presence of lipoid in the epithelia of the kidneys, but does not discuss it further. As far as I know no comparative studies have been made of the organs of children who have died from serious subacute diseases.

The following interesting but insufficiently studied case suggests the possibility of a generalized lipoidosis in true amaurotic idiocy. Davidson and Jacobson, describing the post-mortem findings in a Jewish boy of 19 months, found an atrophic spleen with degenerated cells and an absence of lipoid cells. Lipoid material had gathered in large granule cells within the center of the Malpighian corpuscles. Many of the liver cells were devoid of cytoplasm, many were completely disintegrated, and others contained large vacuoles. With Sudan stain islands of liver cells with definite fatty deposits were observed. Large cells containing lipoid were also noted.

The chemical analysis of the blood was incomplete. From the visceral organs no other stained sections were made, so that although it seems probable that there had been a lipoidosis of visceral organs,

neither fatty degeneration nor a secondary lipoid infiltration (see later) can be excluded from their investigation of the case. Sufficient evidence is not forthcoming to establish the nature of the lipoid material as identical with that found in the brain cells in cases of true amaurotic idiocy.

Schaffer has recently accepted Van Sántha's theory to the effect that the glial affection in infantile cases is secondary to the affection of the ganglion cells. The glial cells are claimed to be phagocytes, especially in his more advanced cases. Van Sántha's statements, accepted by Schaffer, are not in agreement with those of other authors (Spielmeyer, Bielschowsky, Ostertag) who accept an associated primary affection of the glia cells. Only from the literature may it be concluded that cases of Tay-Sachs's disease occur without affection of the mesoderm, though it seems possible that a mesodermal affection may be associated.

Juvenile amaurotic idiocy. The anatomical changes in E. Sjövall's cases presented a striking uniformity. The ganglion cells are swollen with lipoid deposits within the plasma. The lipoid deposits in glia and ganglion cells show, as a rule, no tendency to lac-formation with iron alum hematoxylin. With Scharlach R. the lipoid accumulations take on a dull-red color.

Böhmig and Schob found lipoid in the spleen and lymph nodules in their cases of juvenile (amaurotic) idiocy. In his cases, E. Sjövall also found lipoid within the reticulo-endothelial cells in the spleen and in several lymph nodules which stained a dull red with Scharlach R. and faintly with hematoxylin. This latter test was negative in Schob's case. In Marinesco's case the mesodermal elements were also affected, so that it can be definitely stated that in juvenile cases the affection is commonly a generalized one, not being limited to the ganglion cells. E. Sjövall especially emphasizes the importance of the independent degeneration of the macroglia. Other published cases vary in their reports as to clinical symptoms, localization, the quantity, and even the quality of lipoid degeneration. These reports show that each family has its own peculiar characteristics. ***But undoubtedly both ganglion cells and mesodermal cells are affected in juvenile amaurotic idiocy.*** The chemistry of the lipoid is different from that in infantile amaurotic idiocy.

Adult amaurotic idiocy. Histologically not only the ganglion cells but also the mesodermal cells are affected. In Kufs's case the Scharlach R. test was highly positive, the granules did not take the Heidenhain stain, stained black with Wolter's medullary sheath stain, and the osmium test was faintly positive. In 1931 Kufs described a similar case, onset at 42 years and death at 59. The case was peculiar in the irregular distribution of the cellular degeneration. Another patient with good vision, however, has been described by Denzler. The diagnosis was made on the basis of the pathological findings in the brain, and recently van Bogaert diagnosed a late case on the basis of the pathology, which he was able to differentiate from senile degeneration of the brain.

In Kufs's case of adolescent amaurotic idiocy the ganglion cells were pathologic in the brain, spinal chord, and ganglia, whereas the affection of the glia cells was not so marked. The material stained red with Sudan, not with hematoxylin. The Sudan test was positive in the epithelia of the kidney, liver, endothelia, hypophysis, lymph nodules, and muscles of the heart, whereas the spleen was proportionately less involved. ***In adult amaurotic idiocy both ganglion cells and mesodermal cells are affected.***

Discussion of the Pathology of amaurotic idiocy. The only typical character-

istic common feature of these diseases is the presence of a substance in the cells which stains with Sudan or hematoxylin. In contradistinction to the lipoidoses, in which the chemical nature of the lipoid is known, our chemical knowledge of the amaurotic idiocies is very incomplete. These idiocies cannot be grouped together by histochemical color tests, since such tests clearly indicate that the material found in the various idiocies is not identical.

The idiocies are not connected by an exclusive localization in the nervous cells, which, according to Schaffer, would be a chief characteristic feature of infantile amaurotic idiocy, since in the later varieties mesodermal cells are also affected.

In the retina, affection of the ganglion cells occurs in infantile amaurotic idiocy, whereas the deeper layers of the retina are involved in the later amaurotic idiocies; this is a difference of fundamental importance, apparently inexorably separating both idiocies. As far as I know, no other sense epithelia are affected, therefore it seems more likely that the affection of the sense epithelium in the eye is secondary to a primary affection of the pigmented epithelium, analogous to the independent affection of the macroglia in the later idiocies. In certain areas of the brain the degree of lipoid degeneration of the macroglia even exceeds that of the ganglion cells (E. Sjövall). This will be discussed more extensively later.

It may be concluded that the sole bond between the idiocies lies in a lipoid degeneration predominantly in nervous-tissue cells.

THE LIPOIDOSES (their pathology and chemistry)

The pathology of Niemann-Pick's disease was extensively described in a recent paper by Baumann. It affects chiefly mesodermal cells but also ganglion cells.

As has recently been proved by Lindau, the pathology of the brain cells in Niemann-Pick's disease and the infantile variety of Gaucher's disease is so similar that a close relationship between these two diseases must exist.

The substances in Niemann-Pick's disease, lecithin and sphingomyelin (Baumann, Klenk, and Scheidegger), are related chemically to the kerasine of Gaucher's disease. Lignocerylsphingosine in combination with galactose forms kerasine, with cholin: sphyngomyelin. The presence of sphyngomyelin in Niemann-Pick's disease was demonstrated by Klenk; it is soluble in alcohol but not in ether. The affected cells in Niemann-Pick lipoidosis stain pale-orange or pink with Sudan, black with the hematoxylin-lac method (Smith-Dietrich). Kerasine does not stain and can be detected only by chemical analysis of the organs. This apparently essential difference is of no value, however, since it has been demonstrated chemically that the substance present in the cells is a lipoid in both diseases and chemically closely related to each other. Hence, the fundamental importance of chemical analysis in these diseases is evident. The relationship between Niemann-Pick's disease and Gaucher's disease (especially the infantile variety) is based partly on clinical findings (swollen spleen and liver, cerebral symptoms) and partly on the histological aspect of the cells (sections stained in the usual way with hematoxylin), but the essential bond of relationships lies in the similarity of the chemical structure of the material found in the diseased cells.

In cholesterin lipoidosis the cells contain a pathologic substance which stains with the color tests; but chemical analysis (a method that has brought to light the close relationship between Niemann-Pick's and Gaucher's diseases) in this in-

stance points to a separation, since cholesterin is not a lipoid, but an alcohol. Moreover the pathology differs in that the "lipoid" infiltration does not occur in the original preëxisting body cells, but in the cells of a granulation tissue that develops primarily in the course of the disease. In the eye a granulation tissue may develop, but the presence of a pigmented retinitis or of a macular process has never been reported.

In addition, the hypercholesterinemia that should be regarded as a main feature of "cholesterolosis" is frequently met with in conditions which bear no, or but a very distant, relation to Schüller-Christian's disease. The phenomenon in which body cells become infiltrated with pathologic amounts of a special substance is also met with in Gierke's disease (glycogen), which disease cannot, of course, be classified as a lipoidosis.

On the other hand the "lipoid" found in cholesterin lipoidosis is a mixture and cholesterin metabolism seems to be closely related to fat and lipoid metabolism. The cerebral variety of cholesterin lipoidosis, in which a mixture of cholesterin and fats is found in the brain, is of special interest since it somewhat resembles the other two varieties of lipoidosis. As in these, there is no development of a primary granulation tissue. In contradistinction, however, it has not been reported as showing the typical degeneration of the ganglion cells (van Bogaert). Large deposits of cholesterin occur also in the white matter. Besides his own case, van Bogaert mentions two other cases (rather different from one another), in which neurological symptoms were present. It is of interest to the ophthalmologist that in this case the eyelids were affected.

There occurs a secondary xanthomatosis which will not be discussed here.

It may be concluded that the link between cholesterin "lipoidosis" and the other two affections lies in the presence of a certain chemical substance (not a lipoid), which appears in the body cells without any known cause. This link is strengthened by the fact that cholesterin and fat metabolism seem to be related.

EXPERIMENTS ON THE NATURE OF LIPOIDOSIS AND OF AMAUROTIC IDIOCY

The cause of the degeneration of the ganglion cells in lipoidosis has been claimed to be an infiltration of the ganglion cells with lipoid material from the blood (Bielschowsky). Schaffer considers the degeneration in amaurotic idiocy a primary degeneration, an abiotrophy of the ganglion cells. In respect to this problem experiments are of great interest.

Little is known about lipoid metabolism and consequently of the mechanism of lipoidosis. The theory has been supported that lipoid infiltration of predisposed areas could be induced by changes in the blood chemistry. Such a suggestion is acceptable as regards cells belonging to the reticulo-endothelial system. Blotevogel claims that "Speicherung" can be observed in the ectodermal cells of the growing organism; which, however, is denied by Towbin. Chemical analysis of the blood in Gaucher's and Niemann-Pick's diseases has shown, however, that there may be no lipoidemia. Besides which, parenteral administration of lecithin has no effect at all. When injected intravenously it is found back in the cells of the reticulo-endothelial system (A. Sjövall), but only if injected in enormous amounts. Nothing develops that might confirm the theory of Pick and Epstein, who claim that phosphatides, being hydrophile colloids, are highly dangerous for the organism. According to A. Sjövall, and to Pasternack and Page, the intravenous administration of cephalin has the same negative result. When lecithin is injected either subcutaneously or in-

traperitoneally, the phagocytes contain granules which take the stain of ordinary fats, from which it may be concluded that the chemical structure of the substance alters in the phagocytes. Similar results were obtained by Kimmelstiel and Laas in their experiments with cerebroside. Like cephalin, lecithin disappears rapidly from the body. Therefore it is not possible to produce a chronic lipoidemia artificially. Furthermore it seems doubtful that a change in the blood chemistry can influence the ganglion cells, protected as these are by the blood-fluid barrier. For his experiments A. Sjövall used young animals in which, according to Behnsen, the blood-fluid barrier is less efficient. Moreover A. Sjövall simultaneously injected urotropine intravenously, which, according to Beletzky and Garkawi, artificially increases the permeability. Even so he obtained negative results. From his experiments A. Sjövall concludes that the lipoid content of the cells can be due only to a disturbance of the metabolism of the cells themselves.

Only Beumer and Gruber succeeded in producing a spleen with foam cells in rabbits by feeding them with sphyngomyelin; which, however, was administered in excessive amounts.

Sphyngomyelin in a 5-percent solution was injected in an auricular vein of three rabbits as follows: (1) 2 Kg.: 7 grams; (2) 2.3 Kg.: 6 grams; (3) 2.5 Kg.: 9 grams. The spleen contained large cells which stained faintly and remained practically unstained with the Smith-Dietrich method (hematoxylin lac). The animals were killed 2 to 3 days after the injections had been given. No report of the condition of the ganglion cells was included.

From the experiments it may be concluded that a normal ganglion cell is not affected by lipoidemia, consequently the ganglion cells in the diseases here under discussion must in themselves be abnormal.

It might be suggested that the diseased ganglion cells handle the normal amount of lipoids presented by the blood in an abnormal way, so that these lipoids infiltrate the protoplasm and, since phosphatides are hydrophilic, cause swelling which destroys the cell. But even such a theory cannot be maintained since van Lehoczky (after van Sántha) and A. Sjövall established the fact that lecithinoid granules do not cause a swelling of the cells, all of which again emphasizes the fundamental importance of the condition of the cells themselves.

It may be concluded that both in the discussed lipoidoses and in the amaurotic idiocies there probably exists a defective metabolism of the ganglion cells.

CONCLUSIONS AS TO THE PATHOLOGY OF LIPOIDOSIS AND THE IDIOGIES

At the center of this problem is the relationship of infantile amaurotic idiocy and Niemann-Pick's disease.

1. The way in which the ganglion cells degenerate has also been investigated by studying the pathology (van Sántha and Schaffer). They demonstrated that not all of the swollen cells contained lipoid granules, and, as far as I know, opponents of their theory have not established the presence of lipoid granules in apparently normal ganglion cells, which they claim to be the first step in the development of the pathologic events. However, Feyrter stated that the absence of granules in the cells described by van Sántha is due to the unreliability of his technique. Swollen cells without granules have been described by Gottron in Schüller-Christian's disease.

It may be concluded *that a separation of the two diseases, based upon a histological study of the manner in which*

the ganglion cells degenerate, is not possible at the present moment.

2. The aspect of the ganglion cells in both diseases is similar. Although the lipoid grains are said to be somewhat coarser in amaurotic idiocy, still there are no other morphological features that point to a difference. The color tests for fats and lipoids are practically identical. It is possible that van Sántha's argentophile bodies are characteristic for amaurotic idiocy, but, as far as I know, their presence has never been sought in cases of Niemann-Pick's disease. If Rintelen separates infantile amaurotic idiocy from Niemann-Pick's disease, this separation is based solely upon quantitative, not upon qualitative differences.

It may be concluded that it is impossible to differentiate these diseases either on the basis of the color tests or the morphological appearance of the lipoid granules.

3. The chemical nature of the pathologic substance in lipoidosis is known, but Klenk has found a marked difference between the sphingomyelin in the brain and in the spleen in his case of Niemann-Pick's disease. It is only discussed in infantile amaurotic idiocy. A comparative chemical analysis of the affected organs in Niemann-Pick's and Tay-Sachs's disease has been made by Epstein. This author obtained 15.6 grams of phosphatides from the brain of an amaurotic idiot (Tay-Sachs) as compared with 17.2 grams from that of a normal brain of the same age and 30.6 grams from the brain in a case of Niemann-Pick's disease. The technique of this work has, however, been criticized by Klenk and van Sántha. On the other hand Rintelen recently stated that the chemical substance found in a case of amaurotic idiocy, though a lipoid, differed from sphingomyelin.

It may be concluded that for the present a separation on the basis of chemical analysis is not yet possible.

4. The claimed exclusive affection of the ganglion cells in infantile amaurotic idiocy has been discussed.

Summarizing, it may be concluded that, according to our present limited knowledge, the lipoidosis and the amaurotic idiocies belong to one group of diseases, characterized by a lipoid degeneration of the body cells, but with different localizations and occurring at different ages.

The value of this sole feature in common is nevertheless of decisive importance, since it is the fundamental, if not the only, major pathologic condition underlying the various diseases discussed here.

Therefore the term "essential lipoid degeneration" (predominantly splenohepatic, cerebro-retinal, or even complete) would be preferable.

Related conditions

Since the presence of abundant lipoid in the cells is the chief characteristic of the lipoidoses and the amaurotic idiocies, affections in which similarly diseased cells occur may be related:

1. *Gargoylism* is a rare disease of special interest for the ophthalmologist since the corneal opacities, which are one of its chief characteristics, are difficult to differentiate from those occurring in buphthalmus. Other signs are essential for the making of a diagnosis: typical facies, mental deficiency, cranial deformity, hepatosplenomegaly, kyphosis, and bone changes such as are found in chondro-osteo-dystrophy. There is a lipoid degeneration of the brain. A recent biopsy examination of the liver and the spleen in a case with hepatosplenomegaly showed, however, no lipoid infiltration of these organs, so that at present the evidence is inconclusive.

2. *Senility.* E. Sjövall and Ericsson emphasized the similarities between amaurotic idiocy (adult case) and senility. E. Sjövall says that in these patients the central nervous system is extremely senile at 20 years of age: a senium praecox. In other respects there are marked differences with senility (E. Sjövall, van Bogaert).

3. If emphasis is laid upon the unaccountable appearance of a certain substance in pathologic amounts in the cells, then Gierke's disease (hypertrophy of liver and kidneys in which glycogen is found) may be considered related. Pompe described glycogen hypertrophy of the heart. Probably the nervous system also may be affected (idiocy), so that this disease is of great interest for the problem under discussion, the more so since, as in lipoidoses (van Bogaert), a relation with fat metabolism is also reported.

4. Brouwer in his paper on the diseases of the liver, spleen, and brain includes the lipoidoses in his discussions.

OPHTHALMOLOGICALLY RELATED CONDITIONS

As has been stated previously, the condition of the retina in juvenile cases may point to a relation with macular degeneration or pigmented retinitis:

1. *Macular degeneration.* Behr, Kufs, and Spielmeyer believe that in cases with senile macular degeneration there are probably lipoid changes in the brain also.

2. *Retinitis pigmentosa.* The variety similar to retinitis pigmentosa is most interesting. The father of Kufs's two patients, affected with the late adult variety ("Spätfälle"), suffered from retinitis pigmentosa, so that the problem arises whether retinitis pigmentosa has a similar etiology.

The opinion that the primary retinal lesion of the later idiocies lies in the pigmented epithelium has been supported in this article. But I have no material to substantiate this point of view.

3. *Optic atrophy.* Cases have been reported of optic atrophy in which the fundus was normal in all other respects. Higier reports on an interesting family with amaurotic idiocy in which he found isolated cases of optic atrophy. In late infantile cases optic atrophy is frequent. Kufs describes a case in which there was no optic atrophy and although the fundus was clinically normal the ganglion cells were diseased.

CONCLUSION

The etiology of the "essential lipoid degeneration" is completely obscure. The degeneration cannot be a result of a lipoidemia, but is caused by a spontaneous lipoid degeneration of the cells. The cause may be a primary "presenile," "abiotrophic" degeneration of the affected cells, or it may be seen in a disturbance of internal secretion and of vitamin supply, causing a disturbance of lipoid metabolism and secondarily a degeneration of the affected cells. A most striking example of disturbance of cellular metabolism is vitamin-A deficiency. A deficiency may also affect the nervous system (combined disease of the spinal cord and retrobulbar neuritis) (Hagedoorn).

This point of view is attractive, since it opens the possibility of future treatment of "essential lipoid degeneration" and related conditions, which is the physician's ultimate aim (Spielmeyer).

PATHOLOGY OF THE RETINA

LITERATURE

Infantile amaurotic idiocy and Niemann-Pick's lipoidosis. Greenfield and Nevin have summarized former descriptions of the retina in amaurotic idiocy, the first of which was given by Treacher Collins, who found gross degeneration of

the ganglion-cell layer with a thinning and edema of the macula. This latter condition accounted in his opinion for the typical ophthalmoscopic appearance. In their own case the findings were in agreement with those of Holden and Coats. The layers of the macular region were normally preserved, and nothing but the pathological changes in the ganglion cells was found to account for the macular appearance, edema being nowhere present. The sections were cut after celloidin embedding. The pathological changes were practically confined to the layer of nerve cells, which were swollen and either oval or round. They contained irregularly placed somewhat swollen nuclei which were either clear and granular, or dark, shrunken, and irregular. Lipoid degeneration in the ganglion-cell layer was uniform throughout, the lipoid appearing to fill the whole cell with the exception of a few cells which appeared vacuolated at one or the other pole. The lipoid in the ganglion cells was very insoluble and was not dissolved by celloidin embedding. Greenfield and Nevin gave a detailed report on the microchemical reactions of the brain in their case and a table of such findings in the literature. They conclude: "It will be seen that these reports are so few, and describe such varied methods of examination, that differentiation of types of diseases by the staining reactions of the lipoids is not possible." Hurst developed the technique of histo-chemical investigation in this line, but, according to van Bogaert, a final result cannot be obtained in this way. It is interesting, however, to state that Greenfield and Nevin found that a mixture of equal parts of methyl alcohol and chloroform was the most powerful solvent for the lipoid. Klenk states that the best method of extracting sphingomyelin in his case of Niemann-Pick's disease is to use a mixture of chloroform and methyl alcohol (1:3). Thus it seems not improbable that a considerable part of the lipoid present has been sphingomyelin (Rintelen claims that it is different from sphingomyelin). There was no optic atrophy. The German literature constantly cites the case of Schuster. This author, however, did not stain for lipoid. In addition to the lesion of the ganglion cells he found lesions of the cells of the inner nuclear layer.

The most recent paper is that by Th. Werncke, who studied both eyes of four children who had died from amaurotic idiocy. He describes another patch temporal from the macula. This author believes that edema is the principal cause of the white region in the macula. Lipoid stains were not made.

In a case of Niemann-Pick's, combined with Tay's sign, Goldstein and Wexler found that the degeneration of the ganglion cells was the principal anomaly. Edema of the inner nuclear layer was present, a condition which must be taken into consideration in relation to the elevation of the macula which was observed clinically. The cells of the inner nuclear layer were considerably degenerated. There was a slight atrophy of the optic nerve. No lipoid stains were made.

Rintelen studied Baumann's case and was the first to examine the retina with lipoid stains in Niemann-Pick's disease. He found a lipoid infiltration of the ganglion cells and an edema of the inner reticular and inner granular layers. Large cells in the inner nuclear layer with lipoid infiltration are called Hortega cells. In this case a slight degeneration of the optic nerve was present. Rintelen refused to identify the retina as one of amaurotic idiocy on the basis that the degeneration was not sufficiently advanced. There was, however, no prelipoid dust on the mesodermal element, no Pick's cells were found around the vessels or in the tissues, which, according to van Sántha, distin-

guishes Niemann-Pick's disease in the brain from Tay-Sachs's disease. Only in the episclera were a few staining cells found. Choroid and sclera do not contain many histiocytes as do episclera and retrobulbar tissue.

The later idiocies. The retinal affection in juvenile amaurotic idiocy is always described as starting in the layer of rods and cones, apparently, therefore, being a disease of the sense epithelium. As has been discussed previously, in considering A. Sjövall's description of the pathology of the brain in this disease, it seems more probable that, analogous to the involvement of the macroglia, it is the pigmented epithelium that is primarily affected, causing secondarily degeneration of the rods and cones. It is true that the pigmented epithelium is one of the phylogenetically oldest parts of the retina and therefore cannot be identified with glia. But its nutritional, phagocytic, and proliferative features strongly remind one of this tissue. However, this point is still vague since, as far as I know, no investigation of the lipoids has been made in the various anatomical studies of the retina in juvenile amaurotic idiocy.

A plea in its favor is, however, found in the work of Sugita and Asayama and Takagi, who demonstrated a lipoid degeneration of the cells in a related condition: the pigmented epithelium in retinitis pigmentosa. These Japanese authors based their investigations upon a work of Koyanagi, who in turn had demonstrated lipoid in the pigmented epithelium in a case of cirrhosis of the liver associated with hemeralopia. I have not been able to find any published reports on the lipoid content of the pigmented epithelium in cases of avitaminosis, but in a private case, in which there was an associated hemeralopia, abundant lipoid was found in the pigmented epithelium. In various conditions—senility, sarcoma, inflammations—I found an increased lipoid content of the pigmented epithelium. Nevertheless, the findings in avitaminosis seemed to be rather typical. Professor Heringa was so kind as to study the pigmented epithelium in albinotic avitaminotic rats. It proved to be entirely free from lipoid so that the significance of my findings is not yet clear. It is not impossible that the disturbance of the light sense, not infrequently found in old people, is a related condition. On the other hand, cases of juvenile amaurotic idiocy have been published in which it was claimed "no hemeralopia" was present.

Further support for this point of view is found in the conclusions of Steinberg, who studied the condition of the auditory organ in amaurotic idiocy. On the basis of his clinical findings he concludes that the disturbance of hearing is due to pathological changes in the ganglion cells; though he leaves open the possibility that in a simple combination of retinitis pigmentosa and deafness changes in the organ of Corti may play a role. The supposition that involvement of the ganglion cells is the essential lesion is supported by the histological findings of a case, the only one in which the auditory organ and its nervous apparatus could be studied thoroughly. Siebenmann and Bing found that the histological changes in the peripheral nerves were not severe enough to account for the complete paralysis of the cochlear and vestibular nerves. They found considerable atrophy and hypoplasm of the cochlear neurone in the brain. They conclude that the cause of deafness in amaurotic idiocy lies in pathologic changes in the central nervous system. It is interesting to note that recently Oppikofer in a histological study of the auditory organ and its nervous apparatus concluded that the deafness had to be attributed to changes in the central ganglia.

In Batten and Mayou's case, both gan-

glion cells and the rods and cones were affected with migration of pigment. Kufs claims to have found "typical swelling of ganglion cells" (Kufs, 1929, p. 406).

DESCRIPTION OF OWN CASE

Case history. Brouwer gave the following short summary: The patient belonged to a Jewish family in which no disease of the nervous system has been found. Up to the age of six months she appeared to develop normally; after that she had several attacks of bronchitis. Gradually it became apparent that she did not see very well, and there were signs of backwardness. She was admitted to the hospital at the age of 1½ years. On examination in the neurological clinic (Professor Brouwer) the classical symptoms of amaurotic idiocy were found; there was a beginning hypertonia in the four extremities with increase of the deep reflexes. The pupils contracted to light, but the eyes never followed any object. In both retinae the typical white area in the region of the macula with the red spot in the center was found. While in the ward the child had several general epileptic convulsions; the hypertonia increased gradually and contractures of the extremities developed. Finally the general condition deteriorated. The patient died at the age of two years and seven months.

A report of the changes in the brain was given by Brouwer. No foam cells were found in the mesodermal tissues of the brain. Bielschowsky studied the organs and found foam cells in the spleen and in the heart of this patient. Bielschowsky considers that the presence of these cells proves the identity of this disease with Niemann-Pick's. The quantity of lecithin in the blood increased during the last months of life (425 mgr. percent), the relation between the quantity of cholesterin and lecithin being 1 : 3.17 (normal 1:1.5) (van Crefeld cited by Brouwer).

Pathology of the eye. The pathologist sent us the posterior pole of one eye with a rather large part of the optic nerve attached. The specimen had been preserved in formalin. It was treated as follows: After being washed in water for 12 hours, gelatin sections were made and placed in a saturated solution of thymol, followed by a few minutes' washing in distilled water. Some of these sections were stained for about 12 hours with Sudan III (a solution of the Sudan III stain of Romeis), then washed for a few seconds in 40-percent alcohol, a few seconds in distilled water, restained with hematoxylin, again washed in water for about a half hour, and finally embedded. Other sections were stained with van Gieson stain and still others with hematoxylin-eosin, Weigert, and the Nissl stains: cresylviolet, methylene blue, gallocyanin, Mallory stain.

Microscopic description. The sections stained with Sudan III were very instructive, for even under low magnification they clearly demonstrated the complete and almost selective degeneration of the ganglion-cell layer, though cells of the inner nuclear layer were similarly involved. The protoplasm of the affected cells had taken a distinct pale-orange tinge. This coloring of the ganglion cells was in sharp contrast to the bright-red–orange staining protoplasm of the cells of the retrobulbar fat tissue, thereby indicating that the lipoid material within the ganglion cells must be different from the fat of the ordinary fat cells (figs. 1, 2).

Nerve-Fiber Layer. This layer was apparently free of any marked pathological changes, though it seemed to be considerably reduced in size. Definite degeneration of these nonmedullated nerve fibers is always difficult to prove. When in their course they acquire medullary sheaths—which occurs normally after they have been collected into the optic nerve, and

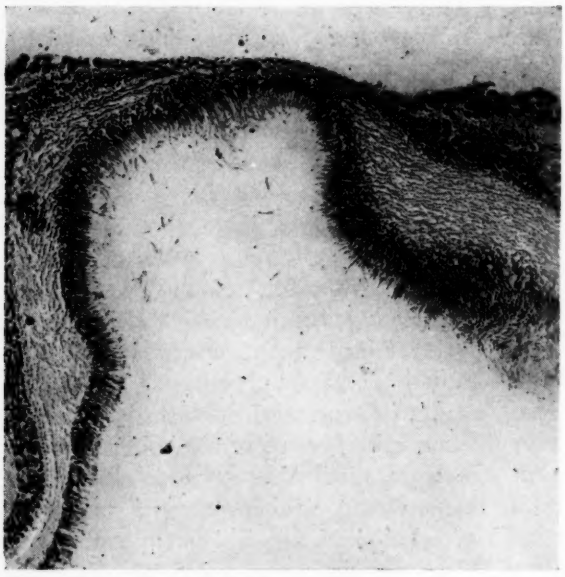

Fig. 1 (Hagedoorn). Macular region. Ganglion cells degenerated and reduced in number. Sudan-Romeis hematoxylin stain (×90).

following their passage through the lamina cribrosa—the condition of the nerve can be readily studied by the use of specific medullary-sheath stains. Figure 3 demonstrates that in the nasal part of the optic-nerve sheaths they seem to have been rather well preserved, whereas in the temporal part they have suffered severely.

Ganglion-Cell Layer. None of the cells were normal, but presented degeneration in various stages (fig. 4). The cell body was considerably enlarged. The nucleus was decidedly pathologic: small, generally irregular, staining with hemotoxylin, homogeneously and often intensively. It could be found in any part of the cell, though usually not in the center. Often it lay pushed against the wall of the cell. Not infrequently a bright (empty) halo surrounded the degenerated cells, probably due to a shrinking of the cell. The protoplasm in all cells stained well with Sudan III, having taken a definite though pale-orange tinge, due to the presence of numerous lipoid globules which, however, were not marked off clearly. Even the protoplasm often took the stain diffusely. There were no vacuoles within the ganglion cells of this specimen. Various stages of degeneration of the ganglion cells were seen. Some were so completely degenerated that only a pale-orange phantom remained. The degeneration of ganglion cells was more advanced in the macular region than at the periphery. Occasionally the degenerated cell-bodies had fused, forming a pale-orange amorphous mass, though as a rule the outline of the cell-bodies could be separately traced. In my opinion it is difficult to

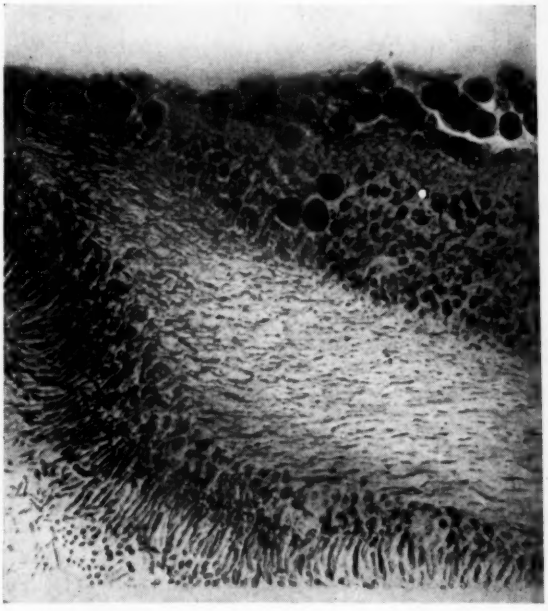

Fig. 2 (Hagedoorn). Macular region. Ganglion cells degenerated (pale orange in the sections, black in the photograph). Sudan-Romeis hematoxylin stain (×225).

judge whether or not this eye originally possessed the normal number of ganglion cells. In comparing this specimen with a normal eye of a child of four years, the relatively small number of ganglion cells in this case becomes evident. Especially is this true of the layers of ganglion cells in the macula. In addition to the ganglion cells many smaller cells were present. They possessed a better-preserved dark-staining nucleus. Their protoplasm, however, had taken on the same pale-orange tinge. They must be glia cells. The condition of their nucleus compared with that of the ganglion cells indicated a less advanced degree of degeneration. The number of these glia cells was not definitely increased. They may have functioned as phagocytes, the lipoid within their protoplasm having come from degenerated ganglion cells. But they stained diffusely, similar to the ganglion cells, and in no instance could I find any evidence of phagocytic action. Nowhere could I find a degenerated ganglion cell surrounded by glia cells. Moreover, they were relatively more numerous at the periphery, just where fewer ganglion cells are seen (fig. 5). Since my specimen consisted of but the posterior pole of the eye, perhaps the term "perimacular region" is more accurate than periphery. Had the glia cells acted as phagocytes it could be expected that at the periphery their protoplasm would be free of, or at most contain practically no, lipoid substance. This, however, was not the case. The cells at the periphery, in so far as this region could be studied, decidedly did not stain less than those in the macular region where, as has been stated before, the ganglion-cell degeneration was more marked. In addition, if the lipoid had been phagocytized it might be assumed that the material had, in all probability, undergone chemical alterations and therefore should stain differently (red; experiments of A. Sjövall). Greenfield and Nevin did not find neutral fats in the glia cells, either, but they found fat-granule cells in which the lipoid was more readily soluble than in the ganglion cells. From these facts it seems probable that the presence of lipoid substances within the glia cells cannot be explained upon the basis of phagocytosis of degenerated ganglion cells.

Fig. 3 (Hagedoorn). Optic nerve. Temporal atrophy; nasal half normal (black in photograph). Smith-Dietrich medullary-sheath stain (×22).

Inner Plexiform Layer. The few cells found in this layer stained as in the ganglion-cell layer (fig. 6).

Inner Nuclear Layer. The protoplasm of the cells constituting the inner layer

of this structure took a pale-orange tint similar to the cells of the ganglion-cell layer, at least to those in the macular region. These were the amacrine cells or the spongioblasts. Towards the periphery the number of staining cells decreased, as did the intensity of their staining, so that there was a gradual fading of the color from the center out. Distinct granules in his case of Niemann-Pick's disease and which he believed to be Hortega cells. The appearance of similar cells in normal retinae stained according to Bodian's technique is in favor of the supposition that they are ganglion cells.

The middle layer of bipolar cells can be regarded as practically normal; it is extremely rare to meet a diseased cell

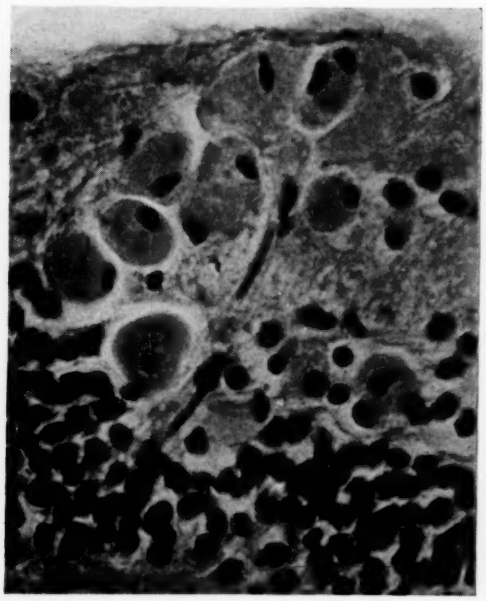

Fig. 4 (Hagedoorn). Macular region. Large swollen ganglion cells with intensively staining shrunken nuclei. Hematoxylin-eosin stain (×685).

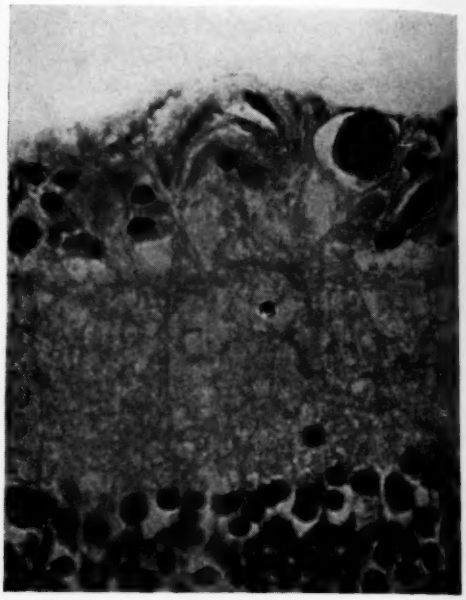

Fig. 5 (Hagedoorn). Peripheral retina. One degenerated ganglion cell and several degenerated glia cells. Hematoxylin-eosin stain (×685).

were not found in these cells, at least not with the Sudan stain. The cells themselves did not give evidence of a severe degeneration; as a rule they stained a lighter orange than did the other degenerated cells. Both in the macular region and at the periphery the color became suddenly more pronounced in certain larger cells. This was especially true in a few isolated cells which resembled ganglion cells. They caught the eye at once by their large swollen orange-stained protoplasm (fig. 7). It is possible that these cells are identical with those which Rintelen found here. The outer layer of cells, the horizontal cells, is often decidedly pathological in the macular region. The protoplasm of these cells stains faintly with Sudan III. Only one vividly staining cell was seen in this region.

Henle's layer appeared very broad, extending rather far beyond the macular region. Just as in the inner plexiform layer, degenerated cells were rarely met.

Spaces (sometimes apparently intracellular) were seen between the cells of the inner nuclear layer and within Henle's layer. They were filled with a but slightly

shrinking substance staining a very pale bluish gray. This edema might have been due to post-mortem changes. It has proved rather difficult to get hold of a normal macula of a child without edema. Nevertheless, the edema in this specimen was especially marked in the diseased part of the retina, though the aspect of the layer of rods and cones indicated that the retina was very well preserved (fig. 8). For the rest, the retina appeared to be normal. The thickness of the outer nuclear layer was about 8 cells. Not a single cell of this part of the retina had taken the stain. The pigmented epithelium and the choroid were absolutely normal. Lipophages were seen nowhere; the vascular walls were normal.

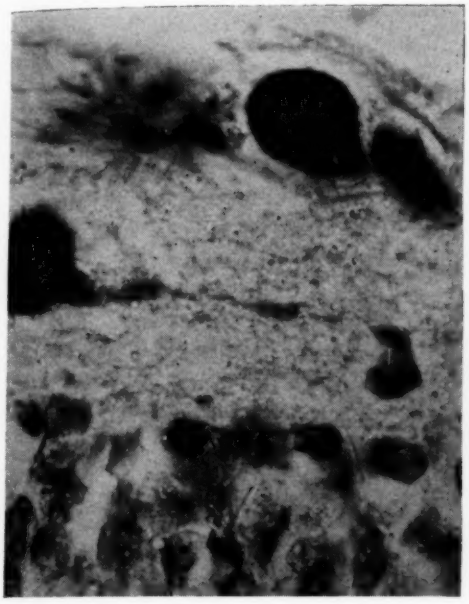

Fig. 6 (Hagedoorn). Paramacular region. Degenerated cells in the inner plexiform layer. Smith-Dietrich stain (×1050).

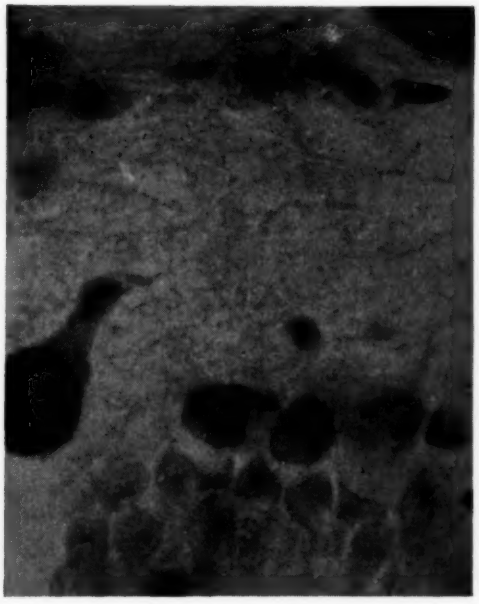

Fig. 7 (Hagedoorn). Paramacular region. Degeneration of inner layer of inner nuclear layer. Smith-Dietrich stain (×1050).

Those sections stained especially for the nuclear structure showed clearly the pathological condition of certain of the nuclei of the inner nuclear layer, which was far less pronounced in its outer region. Especially the gallocyanin-chromalum stain gave good results. Normally these nuclei show a clear reticulated structure, but in these sections the pathological nuclei stained diffusely and intensely (fig. 9). The dark nuclei that one sees toward the left on the photograph are not out of focus, they lack a nuclear structure due to their pathological condition. This stain and other Nissl stains showed the absence of any tigroid substance within the degenerated ganglion cells. Similar dark nuclei have also been found by Rintelen in his case of Niemann-Pick's disease and this author believes these cells to be glia cells.

The Smith-Dietrich stain, a hematoxylin-lac method which stains the lipoids, gave, with regard to the extensions of the disease, a picture similar to that found with the Sudan III test. In the piece of retina available there were no ganglion cells or glia cells in the ganglion-cell

layer that did not stain (figs. 10, 11). Many were completely filled with various-sized dark-blue–black granules. No definite statement can be made as to the size of the granules in this case. At times they were rather coarse, so that the cells became entirely black. Other cells, although they had a darkly stained protoplasm, did not appear to be filled with these granules but had a more spongy aspect. Occasionally the granules were indistinct, whereas the cell-body was considerably swollen. In my opinion these cells cannot be considered as being in an early stage of degeneration. The small intensely staining nucleus argues against it. Practically all of the degenerated cells of the inner nuclear layer, which were much better preserved than the ganglion cells, showed distinct granules within their protoplasm, but it was often difficult to judge whether there was any pathologic swelling of the protoplasm of these cells (figs. 7, 11). The number of cells of the inner layer of the inner nuclear layer which took this stain, equaled that found with the Sudan test. Only a few cells stained intensively. Even faint coloring was of interest; for although, according to Kaufmann and Lehmann, it does not positively indicate the presence of lipoid substances, it nevertheless shows a condition of the protoplasm off the normal. For the rest, the retina seemed to be normal. Occasionally, very dark patches were seen in the nuclei of the nuclear layers and in the rods and cones. The number of these staining elements varied in different regions. This condition was definitely different from that found in the diseased cells. It also occurred in the normal retina.

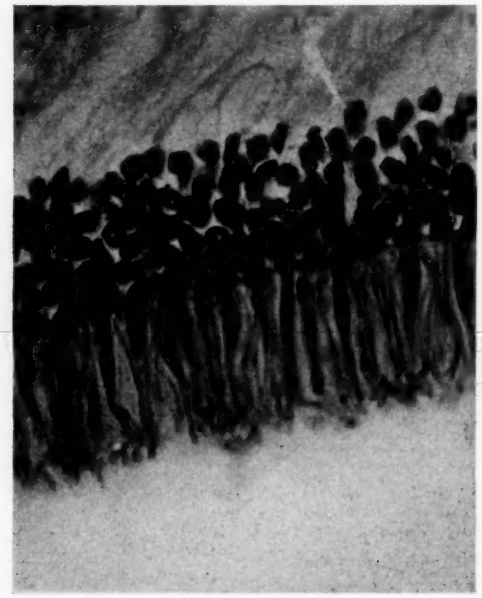

Fig. 8 (Hagedoorn). Peripheral retina. The layer of rods and cones is perfectly preserved. Hematoxylin-eosin stain (×685).

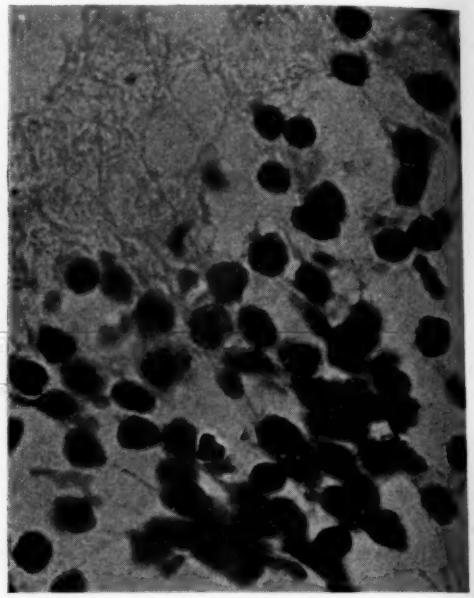

Fig. 9 (Hagedoorn). Macular region. In the center normal nuclei, toward the left homogeneously staining nuclei of diseased cells, lying in focus in the same level. Gallocyanin stain (×850).

The cells in the choroid were normal, the vessels did not show lipoid dust

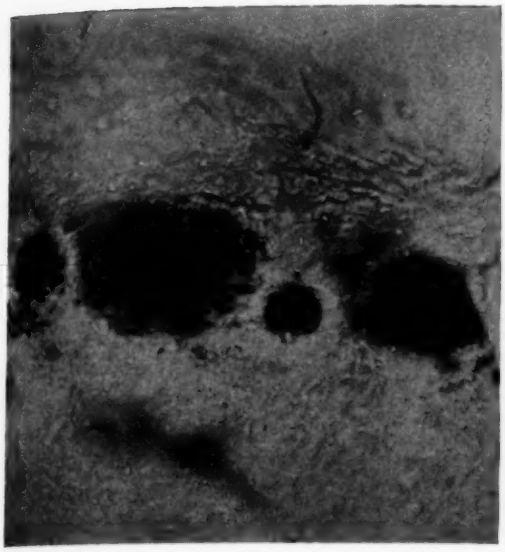

Fig. 10 (Hagedoorn). Paramacular region. Degenerated ganglion and glia cells. Smith-Dietrich stain (×1050).

Fig. 11 (Hagedoorn). Paramacular region. Degenerated ganglion and glia cells. Degeneration of inner layer of inner nuclear layer. Smith-Dietrich stain (×850).

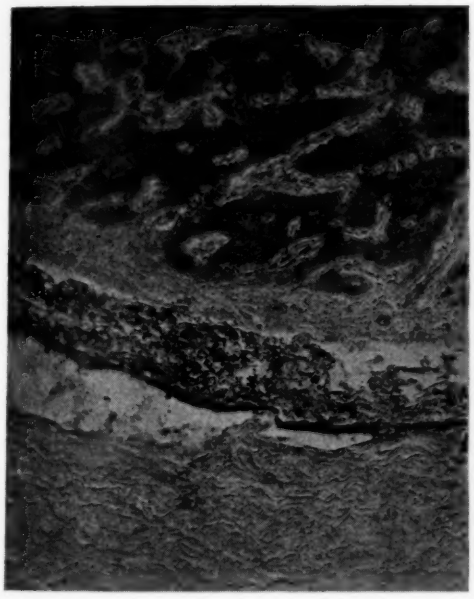

Fig. 12 (Hagedoorn). Sheath of optic nerve. Numerous lipophages (fat-granule cells) in the sheath of the optic nerve (black points and dots in the photograph). Sudan-Romeis hematoxylin stain (×52).

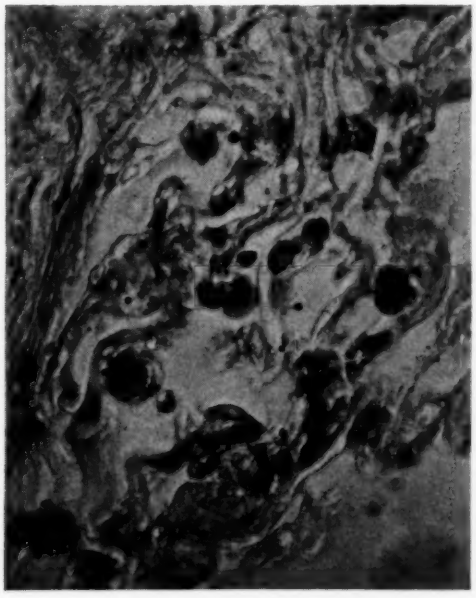

Fig. 13 (Hagedoorn). Sheath of optic nerve. Lipophages in the sheath of the optic nerve. Individual fat granules visible (black in the photograph). Sudan-Romeis hematoxylin stain (×600).

within their cells, and there were no isolated cells containing lipoid granules either in the episclera or in the available part of orbital tissue.

The optic nerve was of considerable interest. With the Smith-Dietrich stained sections a very faint granular or reticular staining of some of the cells in the pial sheath became visible. The Sudan test revealed a very interesting condition. The sheath of the optic nerve, which may be considered as homologous with the arachnoid and pia of the brain, contained numerous cells filled with red Sudan-positive granules, undoubtedly lipophages (figs. 12, 13). For comparison I studied a case of albuminuric retinitis and found a far heavier accumulation of fatty substances in the retina than in this case of amaurotic idiocy. In addition, the choroid and even the sclera contained a considerable amount of strongly Sudan-positive material. On the other hand, the cells in the arachnoid were but faintly stained, only occasionally showing a few Sudan-positive granules, whereas in this case of amaurotic idiocy the sheath was crowded with lipophages which were evidently mobile and for the greater part round. Besides these cells only the ordinary retrobulbar fat tissue stained this same red. In the retina not a single cell was found containing this fat, which, according to the experiments of A. Sjövall, is phagocytized, chemically altered lipoid. They can have collected the lipoid material only from the cerebrospinal fluid. The nuclei of the layer of cells lying close to the dura stained a darkish brown as they did in other eyes which were stained for comparison.

CONCLUSIONS

The pathology of the retina showed: a preservation of the organ of sense, *sensu stricto*, of the rods and cones with the cells immediately connected with them, and of the bipolar cells of the inner nuclear layer. The brain part: The ganglion cell layer was completely involved as were, though considerably less, and especially in the macular region, the horizontal (and amacrine) cells whose function is to connect the retinal elements.

There can be no doubt that the glia and ganglion cells of the retina were similarly affected. Phagocytes, containing lipoid chemically different from that in the diseased ganglion cells, were not found in this tissue. Thus van Sántha's statement that the glial affection is secondary to that of the ganglion cells does not hold, at least not for the retina.

The slight affection of the cells of the inner nuclear layer proves that lecithinoid granules appear in cells that are not considerably swollen, so that Schaffer's point of view, which considers the swelling as primary, could not be confirmed. Probably it occurs simultaneously with the appearance of the granules, but there may be individual variations.

The absence of mesodermal involvement substantiates Schaffer's point of view. This is, however of little value since in Rintelen's case of Niemann-Pick's disease there was also an absence of lipoid in the mesodermal cells of the eye.

The white area seen ophthalmoscopically was caused by the degeneration of the ganglion cells and, perhaps, also by the associated edema. It is fruitless, however, to discuss the role that edema plays, since it is often found in a normal macula of post-mortem enucleated eyes of infants. I had planned to examine a normal infantile macula comparing it with the diseased retina in amaurotic idiocy but I was unable to find one free from edema. Moreover, it should be emphasized that true edema of the retina presents a picture different from that of the

macula in infantile amaurotic idiocy, which can better be compared with that of Berlin's edema. The red spot is in reality a bit of normal choroid visible through the thin fovea, standing out in sharp contrast to the white surrounding.

The presence of lipophages in the sheath of the optic nerve indicates that the process in the brain must have been more advanced than that in the retina. It points to a pathologic lipoid content of the cerebrospinal fluid at the time of death. It is interesting that in the period before death the blood showed a rise of the lipoid content, probably as a result of the degeneration of the brain. Such a secondary lipoidemia is of interest since one might expect it to be considerable in the period before death. It is a condition comparable with the experiments mentioned previously. Mesodermal cells may pick up the lipoid secondarily from the blood.

The findings in the retina in Tay-Sachs's and Rintelen's cases of Niemann-Pick's disease are practically identical. I do not know any other condition in which this typical retinal affection occurs.

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DEVELOPMENT OF MODERN OPHTHALMOLOGY IN ONE LIFETIME*

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The history of ophthalmology covers a period of three thousand years. But the changes that have taken place in the last one hundred years are greater than all that occurred before. Of these later changes we have exact printed records. They affect the things that we know most about. For any historical study we can best begin with our own time. The impressions we gain will then be most exact, best comprehended, and most fruitful for application in the future. The life of Dr. George E. de Schweinitz covered the period of most rapid scientific progress in medicine. We can best honor him by devoting this lecture to considering the changes in ophthalmology that occurred during his life.

Thomas Young had discovered astigmatism in his own eyes; G. B. Airey, the mathematician and astronomer, and Isaac Hays, the medical writer and ophthalmic surgeon, had shown that it could be corrected by cylindrical lenses. Presbyopia had been observed by the Greeks, and myopia defined by Kepler. Ware and others had found that hyperopia was the condition of the majority of eyes. Just one hundred years ago, Schleiden and Schwann had shown that the living cell is the unit of vegetable and animal life. Improvements in the compound microscope had made it an instrument of scientific precision. In this country and in some parts of Western Europe had arisen the idea that every child might learn to read and enter upon the higher mechanical opportunities of our civilization. Vesalius and Harvey and their successors had made anatomy and physiology a foundation of medical education. Pathology with anatomy was recognized as a broad opportunity to study the phenomena of disease. E. R. Squibb, prevented from engaging in the practice of medicine, had, with others, brought to its assistance the resources of chemistry and pharmacy. The discovery of Jenner brought a new conception of disease and its prevention.

In 1858 the chemist, Louis Pasteur, had recognized the share of microörganisms in the fermentations of beer, wine, and milk. He had opened up a new field of biochemistry and the bacterial origin of disease. His work revolutionized surgery and explored the broad field of preventive medicine. The anatomy and physiology of the eye had been developed, close to our present understanding of them, by Wil-

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liam Bowman who, as assistant and prosector to Todd, had contributed a large part of the first encyclopedia of anatomy and physiology, and whose work on the histology of muscles, mucous membranes, and the eye had won him membership in the Royal Society at the age of twenty-six. Influenced by the evident need of his time and the urging of professional colleagues, Bowman gave up general surgery, in which he was already successful, to devote himself to the diseases and surgery of the eye. He had demonstrated that a large part of the ciliary body was of unstriated muscle tissue, and thus furnished the anatomic basis for Young's suggestion that the accommodation of the eye was accomplished by changes in the crystalline lens. He became a surgeon in the Royal London Ophthalmic Hospital. In 1851 Graefe and Donders, visiting London, first met in Bowman's office, and the three formed a friendship that was ended only by death.

Another part of the foundation of modern ophthalmology was laid by Helmholtz. Lecturing on physiology in the Naval Medical School at Kiel, he had occasion to explain the bright reflex of light seen in the eyes of animals at night. To do so he devised the ophthalmoscope, of which Graefe said, when he tried it: "Helmholtz has opened for us a new world." Very soon the intraocular lesions found in general diseases began to attract attention. Helmholtz, confirming and expanding the views of Thomas Young, also invented a means of measuring the curves of the cornea and the crystalline lens, the ophthalmometer. He became so interested in the subject that he began to write his treatise on "Physiological optics," the first part of which was published in 1856. But the physics and physiology of hearing also attracted his attention, taking so much of his time that it was ten years before the last part of his "Physiological optics" was published.

Meanwhile his standing as an authority in physics and his mathematical knowledge gained recognition by scientists, and optics in the use and diseases of the eye became important. In various laboratories of Europe, workers took up the fundamental study of optics; and in the clinics, ophthalmologists began to apply the new knowledge to the study and treatment of cases that came before them. To his predecessors and to his contemporaries, the work of Helmholtz did full justice, both in its text and in the bibliographies prepared for it. This brought together a mass of observations and suggestions of previously unsuspected extent bearing directly on visual optics. Its statement in clear language, with mathematical exactness, gave a great impetus to the study of the subject.

In 1858 Charles Darwin was completing his twenty years' study of observations bearing on the origin of species. His book, with that title, was published in 1859. This edition of 1,250 copies was sold on the day of publication. After two reprints of it had been put out to meet the immediate demand, a revised edition was published in America in 1860. Translations of it were published in other European languages. Darwin's views changed all departments of biology, and are still stimulating new explanations of vital phenomena. They have a place in any review of the development of modern ophthalmology.

The first book on ophthalmology, published in Philadelphia in 1837, was by Littell, a surgeon to Wills Eye Hospital from 1832 to 1864. It gives a clear and accurate account of the ophthalmology of its time. One of its important chapters was devoted to cataract; chiefly to descriptions of the three operations for it: discission, which had been introduced in the preceding century; reclination, to

which most space was devoted; and extraction, which was regarded as an operation so difficult, and attended with such risks, that but few surgeons would be likely to undertake it.

Although it was one hundred years since Daviel had shown that cataract extraction was better than reclination, comparatively few surgeons would do it. General anesthesia, which in twenty years had won its place in general surgery, seemed unsuited for the cataract operation. Those who performed the operation preferred to do it without anesthesia, other than that obtained by a drink of brandy or whiskey. Persons with cataract often went to the end of life without operation. When Richard J. Levis came back from Europe with a mastery of Graefe's modified linear extraction, it is said that he did a thousand cataract operations in his first year or two. Surgeons trained in the pre-anesthetic era depended for success on mechanical skill and rapidity. They welcomed the Graefe operation and the knife with which it was done, because a single, almost painless, thrust gave the operator control of the patient's eye. Dieffenbach in 1841 had done tenotomy for squint; and within three years had used this operation on three thousand patients. One London surgeon did one thousand operations in six months after he had begun to practice it. But in fifteen years the results had so often been bad that the operation was in disrepute. In 1857 Graefe was operating for glaucoma; and the results obtained on patients otherwise doomed to certain blindness rapidly brought iridectomy for glaucoma into favor.

An outstanding feature of modern ophthalmology, as it has been developed during the life of Dr. de Schweinitz, is attention to the refraction, accommodation, and binocular coördination of the two eyes. This became necessary with the spread of popular education for reading, and a thousand mechanical arts of peace that require accurate and easy vision. The great leader in this movement was Franz Cornelius Donders, whose early studies showed a strong bent toward the natural sciences. He began his medical studies at Utrecht, and received his M.D. at Leiden in 1840. His thesis dealt with conditions of the central nervous system. He began teaching anatomy and physiology in the Army Medical School and later was made Professor of Anatomy and Physiology in the University of Utrecht. His work in this direction led to his visit to Bowman in 1851. In 1852 he was made Professor of Ophthalmology at Utrecht.

As a teacher of these three subjects, Donders became a consultant and was thus brought in contact with many individual, concrete cases. He had the practical mind, which in Dutch and English physicians contrasts so strongly with the mathematical precision of the French and the speculative philosophy of the Germans. The practical relief and assistance of the individual patient became Donders's objective in every case; and thus he approached anomalies of ocular refraction and binocular movements. In 1860 he wrote a treatise on "The anomalies of refraction," promising something more extended in the future. In 1864 his book on "The accommodation and refraction of the eye" was published in English by the New Sydenham Society of London. This book arrested the attention of all English-speaking physicians and was soon translated into French, German, and other European languages. Subsequently he wrote fifteen important papers on the refraction and physiology of the eyes and, in 1866, established a physiological laboratory that became famous throughout the world. He became a co-editor of Graefe's Archives in 1855,

and continued that connection until his death, on March 24, 1889. The work of Bowman, Graefe, Helmholtz, and Donders furnished the broad foundation of modern ophthalmology. But it was extended by active workers in Vienna, where Arlt was a great clinician; and the younger Jaeger gave himself to the ophthalmoscopic study of the fundus, reproducing what he saw in paintings that furnished the illustrations for his "Pathologie des Auges," and his Handbuch. Some of these pictures are now in the collections of the College of Physicians, placed there by Jaeger's pupil, William F. Norris. On one of them, it is said, Jaeger spent two hundred hours, a month of daily work!

Ezra Dyer had graduated in medicine at Harvard, where he heard the lectures of Henry W. Williams upon the diseases of the eye. He went to Europe and studied for three years in London, Paris, and Vienna, spending the last months at Utrecht, where Donders was working upon the material for his great book. Donders had suggested the need for test type, based upon the minimum visible angle of five minutes, for the identification of the letters by the normal eye. Dyer, with Snellen, worked on this problem and came to Philadelphia to engage in practice early in 1862. There he had printed cards of Snellen type, several months before Snellen's account of them was published in Europe. S. Weir Mitchell had been graduated in medicine in 1850, at the Jefferson Medical College, and had shown a keen interest in physiology and pharmacology. But the death of his father, in 1852, had forced him to take up a large general practice of medicine, and the Civil War had turned his attention to the effects of injuries of the central nervous system and of nerve trunks throughout the body. He met Dyer with his usual question, "What is new?" He was told of the work of Donders, particularly the effect of errors of refraction upon the general nervous system. Two years later Mitchell read in Donders's book the well-observed and carefully recorded cases of nerve strain through use of defective eyes, and recognized in the cases thus recorded the symptoms of a large number of cases which he began to regard as due to eyestrain. The causation of such cases had been well described by a young English writer, Dalrymple; but so far as can be ascertained Weir Mitchell was the first to call them cases of "eyestrain." He immediately began to send such cases to Dyer for ocular examination and later sent them to George C. Harlan, who had served as resident in Wills Hospital in 1857.

In 1858 Harlan wrote his graduation thesis on "Iritis." William Thomson was graduated at Jefferson Medical College in 1855 and started practice at Merion. In 1861 he volunteered for the Army Medical Service and was assigned for duty in the Surgeon General's Office at Washington. In 1861 William F. Norris had been graduated at the University of Pennsylvania and was also assigned to the Surgeon General's Office. Thomson and Norris introduced the making of photographic records of injuries and of microscopic slides in the Army Medical Museum. Later they, with Dr. Harlan, engaged in ophthalmic practice. To each of them Weir Mitchell referred cases of nerve strain, due to use of the eyes. Dr. Mitchell had a broad view of the coördinating function of the nervous system and understood well the importance of the whole patient as to causes of disease, and an essential element in the securing and maintenance of health. His books on "The rest cure" and "Fat and blood"

illustrate the ideas that he knew must be impressed on patients, as well as on the general medical profession.

His works of fiction contain many allusions and statements that are of practical application in cases of nervous disease. He was the physician who first recognized that the habitual use and strain of the eyes could cause and maintain important forms of disease which might be cured or prevented by removing such strain. He recognized to the full the meaning of the word "doctor"—teacher. He taught what they needed to know, to those who sought his aid. This view of the doctor's duty toward his patient, and to the community at large, was not generally understood by the older members of the profession. But the education of the patient becomes more and more important with the development of preventive medicine.

Wherever Donders's book was read, ophthalmologists began to consider optical defects of the eye as a possible cause of poor vision, or of nervous symptoms not otherwise explained. But in Philadelphia, the book as understood and appreciated by Weir Mitchell created a new field of ophthalmology. Charles Hermon Thomas, resident at Wills Hospital, recognized a case of chronic conjunctival trouble in a sewing woman who had long been treated by blue-stone, applied to the everted lids by a professor of surgery. Thomas borrowed a set of trial lenses from the optician McAllister, corrected her high hyperopia, and gave her complete relief. He then went before the hospital committee of the Board of City Trusts and told the history of this patient, and the first set of trial lenses was bought for the hospital.

General practitioners, hearing of the new remedy for obscure nervous disorders, and what Weir Mitchell thought of it, began to recognize cases among their own patients. Donders had used atropine cycloplegia; and the Philadelphia men, following his example, were soon doing accurate work in correcting errors of refraction. Correcting optical defects of the eye soon shared with operative skill as an objective for the young ophthalmologist. The histology of the retina, the physiology of binocular vision, studies of the blind spot, the apparent distances of double images, binocular perception of depth, corresponding points of the two retinas and the retinal relation to space sense, color perception, and color blindness were subjects that soon began to command the attention of the ophthalmologist.

The American Ophthalmological Society, organized in 1864, held its second annual meeting in New York in June, 1865. At that meeting Ezra Dyer read his paper upon "Asthenopia not connected with hypermetropia." This he found to be due to disturbances of relative accommodation, and treated it by exercises, changing the relations of accommodation and convergence. The president, Edward Delafield, had observed such cases for forty years. He confirmed their importance and the efficiency of graduated exercises. Others present supported Dyer's views. His method of treating, called "Dyerizing," soon received wide attention. At this same meeting the secretary, Henry D. Noyes, read a paper on "Specialties in medicine."

At the meeting in 1867 Gustavus Hay discussed the refraction of divergent rays, and Hasket Derby urged greater accuracy in testing and recording acuteness of vision. Henry D. Noyes reported a case of amblyopia produced by osmic acid. In 1868 Noyes reported his observations on astigmatism; and O. D. Pomeroy reported a case of "acquired astigmatism."

Hasket Derby reported two cases in which acute glaucoma directly followed instillation of atropine. Edward G. Loring read a paper on relative accommodation, and one on insufficiency of the internal recti. In one on the use of prisms, he described the test, subsequently elaborated by Alexander Duane, of observing the movements of the eyes while covering them alternately. John Green presented a new series of test letters for determining acuteness of vision, and new tests for astigmatism. Modifications of the ophthalmoscope, to fit it for measuring refraction, were suggested in 1869 by E. G. Loring and Henry D. Noyes.

In 1873 Hermann Knapp showed a form of ophthalmoscope especially adapted to the measurement of refraction. In 1876 O. F. Wadsworth suggested the tilting mirror to bring the lenses of the ophthalmoscope closer to the eye; and in 1878 Loring adopted the addition of a quadrant to the previous disc of lenses commonly used. That same year William Thomson of Philadelphia showed and explained his ametrometer, in which the diffusion images of two points of light were used for the rapid diagnosis of errors of refraction. These papers indicated the breadth of modern ophthalmology and its interest for the new generation of ophthalmologists.

The fitness of the ophthalmoscope to measure the refraction of the eye has always been an important part of its scientific value. The various modifications of mirror and lens series made, have contributed to the convenience of its use, and the exactness of observations made with it. It will always be needed to measure refraction, because certain things can be determined in no other way. The position of foreign bodies or of exudates in the vitreous is exactly shown by their refraction. The increase in swelling or the depth of cupping of the optic disc can be measured in this way. But it was early found that the ophthalmoscope could be no substitute for cycloplegia, and skiascopy proved a more complete and widely applicable method for the objective determination of the refraction of the eye. However, for observing the progress of clinical changes within the eye the ophthalmoscope will always have great importance.

Skiascopy reached general recognition as an objective method of measuring refraction in about 1881 when Morton, in his little book on refraction, gave a good discription of it. It had been used by Bowman for studying cases of conical cornea and irregular astigmatism twenty years before. Cuignet, of Lille, called attention to it in Paris in 1878. Then it claimed the attention of many writers, under nearly a dozen different names. Parent, demonstrating that the play of light and shadow on the retina was the essential phenomenon of the test, called it "retinoscopy." This name has been extensively used in this country, although in other parts of the world, the "shadow test," of Priestley Smith, shaped into "skiascopy" from two Greek words, meaning "shadow" and "to observe," has been generally adopted.

The apparatus necessary for it is extremely simple: essentially a plane or concave mirror to reflect the image of a point of light upon the eye, with a sight-hole in the center, to observe the apparent movement of light in the pupil. It has been generally recognized as the most exact and generally useful objective method of measuring ocular refraction, being applicable to the illiterate, to children, and to lower animals. It is also most complete, because it indicates the refraction in every part of the dilated pupil.

The subjective testing of refraction, by placing lenses before the patient's eye

and finding which give the best acuteness of vision, has gradually developed until it is now the most accurate and most widely used method of measuring the anomalies of refraction and accommodation. It began with makers of lenses, who mounted lenses in frames and allowed their customers to choose, from a general assortment, the glasses they wished to buy; just as they chose among watches, rings, and other ornaments which pleased them. When doctors, or ophthalmic surgeons, began to prescribe glasses, the need for trial sets of the different lenses arose; and these became more elaborate and extensive as knowledge of the optical defects of the eye increased.

At the hands of manufacturing opticians the forms of trial lenses and the frames to hold them before the eyes have undergone elaboration beyond the requirements of scientific simplicity or convenience in use. It may be hoped that as physicians come to understand fully what is needed, and what is most convenient, such false "improvements" will be eliminated. Trial sets have been made with intervals between the different lenses of only one-eighth diopter. Very few patients can discriminate accurately enough to tell which of two glasses so nearly alike enables them to see better. When cross cylinders were proposed by Stokes, the theory was that the one pair of cylinders could be used to correct any amount of astigmatism, whatever its meridians. Experience has shown that weaker cross cylinders of fixed strength, that may be instantly reversed, are more accurate and far more convenient. Donders, Dennett, and others tried to put the Stokes lens to practical use. But none of them found it a help to scientific accuracy. Elaborate trial frames have generally proved unsatisfactory in the hands of others than the inventors.

The finished highways of civilization rarely conform to the trails of explorers. The balanced judgment of experience does not follow closely the first impressions of those who made important discoveries with reference to the physiology and practice of binocular vision. Dieffenbach's operations for squint aroused the interest of ophthalmologists in the ocular movements and the correction of their anomalies. But in a few years these operations so often failed to bring permanent, desirable results that they fell into disrepute. Only when the influence of errors of refraction was understood, with the dangers of insufficient or excessive bad effects from an operation, could such readjustments of the extraocular muscles be relied on. When Donders, Graefe, and Critchett recognized these new elements that affected the result, the profession could accept the displacement of muscular insertions as a legitimate therapeutic procedure. Only by the slow process of trial and error, through two generations, have we reached our present understanding of operative adjustment of the ocular movements. The immense enthusiasm of George T. Stevens attracted the attention of ophthalmic surgeons to the significance and effects of the phorias. But long professional experience was needed to formulate our present general views on these anomalies of movement and their proper correction. The students who, like Maddox, used simple apparatus and sought the limits of physiologic variations, and how these variations could be controlled by training, have helped to correct the excesses of operative enthusiasm. It still remains for such experience to determine how general and how permanent are the benefits from our later methods. In our airplane view of the progress of modern ophthalmology, many unproved suggestions and promising procedures must be left unmentioned.

The conclusions of Dyer, Graefe, Lor-

ing, Stevens, and Maddox with reference to binocular movements must still be restudied and judged by what we now know of the development of the eye and its different functions. In this field a new worker, Stutterheim, of Johannesburg, working in a population so different from any in Europe or North America, has seemed to think the importance of convergence greater than that of accommodation in the causation of nerve strain and disability for the requirements of civilized life. It is interesting to note that in one of the latest books on this subject, "Extraocular muscles," by Peter, one fourth of its pages and one third of its illustrations are devoted to the anatomy and physiology of the ocular movements, and only one eighth to surgical technique.

Although for more than one hundred years the wards and beds of general hospitals have been open to ophthalmic surgeons, especially in Vienna and Paris, there was no special institution devoted to the treatment of diseases of the eye until 1805. On March 25th of that year, the London Infirmary for Eye and Ear Diseases was opened. Later it developed into the Royal London Ophthalmic Hospital. In 1836 the Duchess of Kent and her daughter the princess (soon to become Queen Victoria) took the institution under royal patronage. The London Dispensary for Curing Diseases of the Eye and Ear was started because Cunningham Saunders had studied surgery with Mr. John Hill of Barnstable, who was not a Fellow in the Royal College of Surgeons. Although Saunders had been assistant and demonstrator of anatomy for Sir Astley Cooper, he could not hope to be the head of a surgical service in any London hospital. It was pointed out that, following the Napoleonic campaigns in Egypt, many soldiers had returned to London with infected eyes. Among the 636 veterans of the 52d Light Infantry, 50 had lost both eyes, and 40 others had lost one eye. Saunders soon found himself busy. In the first year the records showed 600 admitted, 500 cured. In the fourth year 2,357 were admitted, 1,970 cured. In January, 1808, treatment of the ear was given up, and the institution was devoted entirely to diseases of the eye. In 1810 Saunders died of "brain disease." He had suffered acute attacks of very severe headaches, and impairment of the sight of his right eye. But at the post-mortem examination no "tumor" was found, the immediate cause of death being "cerebral hemorrhage."

Saunders's successor was Benjamin Travers, whose father was a director in the East India Company. In 1819 Travers was asked to name a surgeon to be sent to India. R. Richardson went to Madras and established the eye infirmary which, since 1888, has been known as the Government Ophthalmic Hospital. In 1824 two other surgeons who had studied with Travers were sent to India: Mr. Jeafferson to Bombay and Mr. Egerton to Calcutta, where each founded an eye hospital. In 1811 the London Infirmary was opened to medical students; and in the next seven years was attended by 412 of them. In 1818 Edward Delafield and J. J. Kearney Rodgers returned from London to New York and opened the New York Eye and Ear Infirmary. Edward Reynolds, returning to Boston, found his father, a doctor who had practiced many years in Boston, blind with cataract. When the son had restored his father's sight, the Massachusetts Charitable Eye and Ear Infirmary was established.

Wills Hospital for the Blind and Lame was established by bequest of James Wills, an Englishman familiar with what had been done in London, who left his estate for that purpose. It was opened in 1834 with Squier Littell, Isaac Hays,

George Fox, and Isaac Parrish as the surgeons. The history of this institution has been well told in the volume prepared by William C. Posey and S. H. Brown. The development of ophthalmology in Philadelphia has been very similar to that in London. In 1862 the Governors of the Royal London Ophthalmic Hospital, fearing that young men would seek positions on its staff to acquire skill that would be applied in the service of other hospitals, adopted a rule that upon being elected surgeon they must, within three months, resign their connection with other institutions. In Philadelphia, in 1878, the four surgeons of the Pennsylvania Hospital, William Hunt, D. Hayes Agnew, R. J. Levis, and T. G. Morton, had all been surgeons to Wills Hospital. But after their resignations from that institution, their places were taken by men who were devoting their lives to the practice of ophthalmology: George C. Harlan, Ezra Dyer, William F. Norris, and William Thomson.

In 1858 ophthalmology was ophthalmic surgery. All its great leaders had been surgeons, rather than physicians. Many of the older members of the Ophthalmological Society of the United Kingdom qualified for practice as surgeons, and some of them never obtained the degree of M.D. But the new world opened by Helmholtz with his ophthalmoscope is wider than the field of surgery. All the more complete treatises on ophthalmology devote space to the anatomy, physiology, and pathology of the eye, and parts related to it in disease. Sometimes these are considered in separate chapters, more often in close connection with particular diseases or conditions for which patients seek relief. The books recognized as belonging to ophthalmology now include treatises on special subjects that extend beyond what were formerly recognized as the limits of our special branch. In 1871 Thomas Clifford Allbutt, a young man practicing general or internal medicine in Leeds, England, wrote a book on "Medical ophthalmoscopy." It dealt especially with eye conditions seen in diseases of the cardiovascular system, the kidneys, and the central nervous system. It was illustrated with plates, showing the lesions of the ocular fundus. This young man subsequently became the editor of Allbutt's "System of medicine," eight volumes, and was Regius Professor of Medicine in the University of Cambridge, when Osler was Regius Professor at Oxford.

Sir Jonathan Hutchinson attained eminence in several different branches of medicine and surgery. In 1862 he was elected surgeon to the Moorfields Hospital, and in 1863 published his book entitled, "Diseases of the eye and ear consequent on inherited syphilis," which consisted mainly of articles he had previously published in the Ophthalmic Hospital Reports. He was assisted in his service by John Hughlings Jackson, to whom Sir Clifford Allbutt had dedicated his book on "Medical ophthalmoscopy." In that service Hughlings Jackson made the observations that connected optic neuritis, or papilledema, with brain tumor and other coarse diseases of the brain. Hutchinson, when asked what was his greatest medical discovery, replied: "Hughlings Jackson." Hughlings Jackson, the great neurologist, in his Presidential Address before the Ophthalmological Society in 1889, said: "It was the luckiest thing in my early life, that I began the scientific study of my profession at an ophthalmic hospital." It was in the Hospital Reports for 1871 that Hutchinson published "Statistical details of four years' experience in respect to the form of amaurosis, supposed to be due to tobacco." Edward Nettleship, broadly interested in pathology, held for two years the post of curator for

the museum, while he was serving as clinical assistant to Hutchinson. John Herbert Parsons was curator to that museum from cal assistant to Hutchinson. John Herbert lication of his great four-volume work on "The pathology of the eye," which is an index to the foundation of observation and learning upon which modern ophthalmology rests.

From the acceptance of Darwin's views of the "Origin of species," we have recognized the importance of the development of the individual. In 1928 Miss Ida C. Mann published her book on "The development of the human eye," the first book of the kind in English and the most complete in any language. Continuing her studies she brought out a book of 444 pages, 284 illustrations, on "The developmental abnormalities of the eye." These books were published by the Cambridge University Press for the British Journal of Ophthalmology. Miss Mann is a Fellow of the Royal College of Surgeons, England, and a Surgeon to the Royal London Ophthalmic Hospital. Equally worthy of mention, in this connection, is "The text-book of ophthalmology" by Sir W. Stewart Duke-Elder. Its two volumes, already published contain 2,094 pages, with 1,764 illustrations and 30 colored plates. Two more volumes are promised. This book justifies special attention because its bibliographies on each subject bring before the reader the present ophthalmic literature of the world.

One who would know, even imperfectly, the literature of modern ophthalmology is pledged to a life of study. That is what George Edmund de Schweinitz realized in 1881, when he received the degree, Doctor of Medicine. He also pledged himself to do all he could to improve and develop that literature, and in every way possible to raise the standards of education for his profession. From the medical school he joined a quiz organization, in which he quizzed on therapeutics. When made a lecturer on ophthalmology in the University of Pennsylvania, he introduced lectures and training in the use of the ophthalmoscope for all undergraduate students of medicine. In 1888 he became Professor of Diseases of the Eye in the Philadelpia Polyclinic. In 1892 he was made head of the eye department of the Jefferson Medical College. In 1902 he became Professor of Diseases of the Eye in the University of Pennsylvania, succeeding his teacher, William F. Norris. These were not merely honors that he graciously accepted, they were opportunities he used for the education and advancement of his colleagues and his profession. He worked for years in the clinic of S. Weir Mitchell, at the Infirmary for Nervous Diseases. There he worked with William Osler, who suggested, in 1887, that he write an ophthalmic surgery for students. The book was published in 1892: "Diseases of the eye, A handbook of ophthalmic practice for students and practitioners." From that time, through its tenth edition in 1924, it was steadily kept abreast of the marvelous advances of modern ophthalmology.

In 1905 Dr. de Schweinitz joined in editing the Ophthalmic Yearbook. For five years he did his full share of the work it required. After that others were ready to take part in the work of helping practitioners to keep up with advances of the time. In 1897 he was made chairman of the Section on Ophthalmology, and in 1916 president of the American Medical Association. When it was decided to hold an International Congress of Ophthalmology at Washington, in 1922, Dr. de Schweinitz was made president. By his dignified grace and uniform courtesy, the Congress was a success. It led to the Congress of English-speaking Ophthalmological Societies in London in 1925, and to the Thirteenth International Congress of Ophthalmol-

ogy, held at Amsterdam, in 1929.

Dr. de Schweinitz was president of the American Ophthalmological Society in 1916. In 1923 he gave the Bowman Lecture before the Ophthalmological Society of the United Kingdom, and an address to the Société française d'Ophtalmologie. He was also an honorary member of the Société belge d'Ophtalmologie, of the Ophthalmological Society of Egypt, and of the Royal Society of London.

Scattered through the older literature are accounts of poisoning, sometimes causing blindness, chiefly by mineral poisons, lead, arsenic, mercury, and by quinine, alcohol, and tobacco. Dr. de Schweinitz studied this subject and for his essay on "Toxic amblyopias," received the Alvarenga Prize of the College of Physicians in 1892. When published, his work became the standard textbook on this subject. In later editions of "Diseases of the eye" he included the practical facts brought out in the essay, and additional observations published in the literature since that time. This beautifully illustrates his alertness to progress, and his readiness to do justice to the discoveries and conclusions of others.

A most powerful influence in the development of modern ophthalmology has been exerted by the formation of ophthalmological societies. The oldest ophthalmological society claiming national representation is the American Ophthalmological Society, which will hold its seventy-fifth annual meeting next June. The Deutsche Ophthalmologische Gesellschaft was first known as the Heidelberg Congress. It sprang originally from small gatherings of Graefe's personal friends. In 1880 the Ophthalmological Society of the United Kingdom was organized with Sir William Bowman as president. The Société française d'Ophtalmologie was formed in 1883.

America has two other national organizations devoted to ophthalmology: the Section on Ophthalmology of the American Medical Association was formed in 1878, with Dr. Hermann Knapp as chairman. The Western Eye, Ear, Nose, and Throat Society was formed in 1896, with Adolf Alt as president. When its membership extended to all parts of the country, its name was changed to the American Academy of Ophthalmology and Oto-Laryngology. There is now a Canadian Ophthalmological Society and, in the United States are ten regional and seventy state and local societies devoted, partly or wholly, to ophthalmology. These societies generally meet four to six times each year.

In the last twenty-five years there have developed many graduate courses in ophthalmology. Some of these, in strong universities, require two full years of graduate study by students who have taken the degree of Doctor of Medicine, and confer a special graduate degree. The larger number of courses are more brief —one or two weeks—for doctors who are already engaged in the practice of ophthalmology. There has also been, for twenty-four years, the American Board for Ophthalmology, appointed by the three national organizations. This board examines candidates as to fitness for ophthalmic practice, and gives its certificate to those whom it finds competent. These institutions have all contributed greatly, in America, to the development of modern ophthalmology.

In the lifetime of George Edmund de Schweinitz, ophthalmic surgery was entirely reshaped and widely extended. Diseases of the interior of the eye were recognized, seen, and studied during life. The physiology and significance of visual optics, and the effects of its disorders on the central nervous system and general health were recognized and widely relieved. The poisons causing amblyopia

were understood and classified. The conditions of ocular health were made the objectives of ocular treatment, and the health of the whole body as the basis of the health of any part. Knowledge of the development of the eye gave us an understanding of congenital anomalies and deficiencies. In this development and organization of modern ophthalmology, Dr. de Schweinitz contributed a large part. It is left for us, and those who follow us, to give to ophthalmology its rightful place in preventive medicine of the future.

Republic Building.

THE QUESTION OF THE RICKETTSIAL NATURE OF TRACHOMA*

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A considerable volume of literature on the subject of the possible rickettsial nature of trachoma has accumulated since 1933. Opinion as to the identity of the etiological agent of trachoma has fluctuated from considering the inclusion body of Halberstaedter and von Prowaczek[1] (1907) the cause of trachoma to attributing to *Bacterium granulosis* of Noguchi[2] (1928) this function; again the inclusion body of Halberstaedter and von Prowaczek was held responsible, and more recently bodies of a rickettsial nature, though it is conceded that the latter are probably identical with the "elementary bodies" which represent one stage in the evolution of the inclusion body. The inclusion body of Halberstaedter and von Prowaczek is still regarded by most investigators as of importance. The experiments of Thygeson[3] have confirmed the etiological role of the inclusion body in the disease. Using material filtered through Elford membranes of such pore size that the elementary bodies passed through, he produced typical trachoma with inclusion bodies in a human volunteer.

The proponents of the rickettsial theory of trachoma, including Busacca[4] and Cuénod and Nataf,[5] have suggested that the bodies which they have seen are much more numerous than are the typical elementary bodies, which, if true, is a matter of considerable importance. While the question of the rickettsial nature of the organism is more or less academic, since it is not generally agreed how rickettsiae should be defined, still the opinions of Cuénod and Nataf and others have raised a number of questions which are of a certain practical importance, such as the theory of louse transmission and the Weil-Felix reaction as a diagnosis of trachoma.

REVIEW OF THE LITERATURE

"Rickettsia" in trachoma. Busacca[4] first reported to the Fourteenth Congress of Ophthalmology, held in Madrid in 1933, that he had observed bodies occurring in smears and histologic sections from trachomatous patients which, by reason of their morphology and staining reactions, he considered should be classified as rickettsiae. These were present in the follicles as well as in the epithelial cells. He considered them different from the elementary bodies of von Prowaczek, though some of his illustrations show bodies in epithelial cells stained with Giemsa which appear to be typical elementary bodies such as have been seen

* From the Division of Infectious Diseases, National Institute of Health, U. S. Public Health Service.

by the writer in many preparations. These are the very small coccoidal bodies occurring singly and in pairs. Other illustrations show bodies less typical in that they are less uniform in morphology, size, and staining characteristics.

Cuénod in a preliminary publication issued in 1935[5] described "rickettsial" elements which were both numerous and constant in trachomatous tissues, particularly in the trachoma follicles. He found two principal forms, one extremely small, which he suggested might be considered as corresponding to the "elementary bodies," and another a little larger, which he thought might be analogous to the "initial bodies."

When the pulp of a trachoma follicle was spread on a slide, there were found in addition to the elements usually described (epithelial cells, small mononuclear cells, red blood cells, Leber cells) small fragments of protoplasmic débris of variable forms and dimensions. In these fragments were found punctiform elements more or less distinct. Though the presence of these points was considered indisputable it is stated that it was difficult to describe their exact form—they sometimes appeared elongated or oval in shape, and sometimes rounded. In a later publication[6] Cuénod and Nataf speak of these fragments of protoplasm as "plastilles" (droplets of cytoplasm). In the neighborhood of the protoplasmic débris could be found innumerable elements which were very pale and of extreme fineness.

As further evidence of the rickettsial nature of trachoma Cuénod and Nataf[7] cite experiments in which lice were inoculated with trachomatous material, according to the method of Weigl. Rickettsiae were demonstrated in the intestinal tract of such infected lice. Some of the organisms, as shown in their illustrations,[8] are typically rickettsial in morphology, being bacillary, and are of comparatively large size, although minute forms are also shown. With the macerated louse intestines a mild trachoma was produced in an adult monkey[8] and a condition of somewhat greater severity and of longer duration in a *Macacus inuus.* A human subject was also inoculated with louse rickettsiae and a follicular condition developed followed by typical trachoma. In the tears and desquamated epithelial cells, forms resembling those in the louse intestine were no longer found, but instead forms which were identical with those of the inclusion bodies of Halberstaedter and von Prowaczek. Thus they consider that the suspected identity of the von Prowaczek bodies with the intrafollicular rickettsiae has been demonstrated.

The hypothesis was proposed that the louse may be the vector of the trachoma virus. It was also suggested[9] that the theory of the rickettsial nature of trachoma was strengthened by the observation that maps showing the geographical distribution of trachoma were superimposable on those of typhus.

Concerning the relationship of the rickettsiae of trachoma to other known rickettsiae, Cuénod and Nataf[10] express the belief that they may be identical with *R. rocha limae* or at least closely related to it. This hypothesis is challenged by Weigl.[11] The intra-anal inoculation of trachoma material into normal lice gave entirely negative results in his hands and *R. rocha limae* did not infect lice. Serum from trachoma cases failed to agglutinate *R. rocha limae,* nor was agglutination in significant titer obtained against OX-19, OX-K, and *R. prowazeki.* Negative results in louse experiments similar to those obtained by Weigl have recently been reported by Braley.[12]

Poleff[13] inoculated the anterior chamber of rabbits, chickens, and guinea pigs with trachomatous material and produced

an intraocular and a conjunctival folliculosis with a chronic evolution and a tendency to cicatrization of the follicles in the interior of the eye. "Rickettsoïdal" elements were seen resembling those described by Busacca, Cuénod and Nataf, and those which he himself had observed in the majority of his trachoma cases.[14]

Following this Poleff[15, 16] obtained multiplication of the "corpuscles rickettsoïdes" by the method of explanation of tissue *in vitro*. They occurred in the cells as well as in the spaces between the cells and were also disseminated in the media. Poleff believed these bodies to be identical with the "Rickettsiae" described by Busacca and by Cuénod, and he states they also resembled the so-called "elementary bodies" of Halberstaedter and von Prowaczek. The illustrations in Poleff's publication show numerous small discrete coccoidal bodies occurring singly and occasionally in pairs, which rather definitely resemble the elementary bodies.

Cuénod and Nataf[17] reported the cultivation of the "rickettsoïdal elements" in the chick embryo and in the Nigg-Landsteiner medium in flasks. The chick-embryo cultures were continued through seven passages. In the chorio-allantoic membrane there were present rickettsiform elements which, they state, were three to four times smaller than the rickettsiae of typhus fever.

Foley and Parrot[18] support Cuénod and Nataf in their belief in the rickettsial nature of trachoma and propose the name *Rickettsia trachomatis* for the causal agent.

The Weil-Felix reaction. Derkač[19] in 1937 suggested the theoretical possibility of a positive Weil-Felix test in trachoma, and tested 20 serums of which 5 gave a positive test. He did not, however, consider his results conclusive at that time. The results obtained later by Poštić appear to have strengthened Derkač's belief in the rickettsial nature of trachoma, and he considers that there may be a relationship between the organisms of trachoma and those of typhus fever.[20] He suggests that there may be several groups of trachoma rickettsiae, and that each endemic area has a different variety, each giving a different agglutination titer. He states that he found a certain histological analogy between typhus exanthematicus and trachoma in the formation of small follicular masses around the blood vessels.

Poštić[21, 22] in 1938 and 1939 reported the results he obtained in making the Weil-Felix test of serums from 120 trachoma patients. Only those serums which agglutinated OX-19 in dilutions at a minimum of 1:100 were considered. There were 82 cases (68.3 percent) which gave a positive Weil-Felix test with titers as follows:

1:1600 5 cases
1:800 5 cases
1:400 17 cases
1:200 31 cases
1:100 24 cases
(4 with syphilis)

In 25 cases of various other ocular maladies, eight cases (32 percent) gave positive Weil-Felix tests:

1:400 1 case
1:200 4 cases
1:100 3 cases
(5 with syphilis)

Of 15 patients with healthy eyes five (33 percent) gave a positive reaction:

1:400 1 case
1:200 2 cases
1:100 2 cases
(All without syphilis
2 typhus exanthematicus
1 Wolhynia fever)

Poleff and Nain[23] reported results of the Weil-Felix test on 100 serums from

trachoma cases in Morocco. Of these 9 were negative; 16 agglutinated OX-19 in a dilution 1:25, 25 in dilution 1:50, 12 in dilution 1:100, 19 in dilution 1:150, 19 in dilution 1:200, and one in dilution 1:500. Considering agglutinations at 1:100 or over as positive, 67 percent of the active cases (Tr. II-III) were positive and 27 percent of the cicatricial cases (Tr. III-IV) were positive, an average of 51 percent of all cases. Among 50 nontrachomatous controls a positive Weil-Felix test was obtained in only two.

Djourichitch and Loukitch[24] state that in order to study the analogy between typhus exanthematicus and trachoma they tested serums from 105 trachoma cases against Proteus OX-19 using dilutions 1:10 to 1:320. Their results are shown in the following table:

	Stage			
	I	II	III	IV
Cases	7	22	34	42
Positive	57.1%	68.2%	67.6%	76.2%
Negative	42.9%	31.8%	32.4%	23.8%

The following results were obtained in normal controls:

	No. of cases	Percent
Positive	40	38.9
Negative	60	61.1

Noury[25] (1938) isolated another strain of proteus (OX-N) from the blood of trachomatous patients. The serums from 50 cases, of which 34 were active and 16 cicatricial, were tested against this strain and four found positive—three in dilutions of 1:50 and one in a dilution of 1:100. Seventeen normal serums tested against OX-19 were negative. Against Proteus OX-K, 21 serums out of 40 gave positive reactions in titers of 1:50 to 1:200. In another series, 51 serums were tested against OX-N and 23 were positive in titers of 1:50 to 1:200. Two serums agglutinated in dilutions of 1:500 and 1:1000.

Durand and Lumbroso[26] tested 400 serums from cases: (a) having active trachoma; (b) recovered from trachoma; and (c) normal with no trachoma history, against Proteus OX-19, OX-K, OX-2, and TrN. As the result of their tests they consider these strains valueless in the diagnosis.

Manditch[27] in 1939 tested 100 serums for Weil-Felix and Widal reactions; 50 from trachomatous patients and 50 from nontrachomatous persons in Jugoslavia.

The Weil-Felix test was positive in 23 of the 50 trachomatous cases (45 percent and in 15 out of the 50 nontrachomatous (30 percent). Sixteen of the trachomatous serums agglutinated in a titer of 1:100 and 14 of the nontrachomatous agglutinated in the same titer. Manditch therefore considers the results of little significance. There appeared to be a parallellism between the Weil-Felix and the Widal reactions in both trachomatous and nontrachomatous individuals. Manditch concludes that the Weil-Felix test is of no diagnostic value in trachoma and also questions the role of rickettsiae in trachoma.

Experimental

In an effort to elucidate the matter of the rickettsial nature of trachoma, the problem was considered from the following points of view:

1. Comparative morphology and distribution in the cell of true rickettsiae and the elementary bodies of trachoma.
2. The Weil-Felix test using OX-19, OX-2, OX-K and Noury's proteus as antigens.
3. Agglutination tests using as antigens suspensions of the organisms of three rickettsial diseases; namely, endemic typhus, the "Q" fever of Australia (Bur-

net and Freeman[28]), and Nine Mile fever, the latter being possibly closely related to "Q" fever as shown by Dyer.[29]

Morphology and distribution of organisms in the cell. It is generally accepted that the rickettsiae are typically bacillary in morphology, though it is well recognized that they are also pleomorphic particularly in the cells of arthropods and perhaps to a less extent in certain cells in mammals. Very small coccoidal and irregularly shaped forms occur, packing the cells of the intestinal tract of the rat flea infected with endemic typhus and of *Dermacentor andersoni* infected with Rocky Mountain spotted fever. A recent observation in my own work has been that the rickettsiae of endemic typhus, when seen in the lungs of mice and rats following intranasal inoculation according to the method of Castaneda,[30] are very minute and less definitely bacillary than when seen in guinea-pig-tunica preparations or in cultures. The organisms of Nine Mile fever and "Q" fever are definitely bacillary when seen in the tissues of guinea pigs and mice, though they are smaller than the rickettsiae of endemic typhus and Rocky Mountain spotted fever, and filterable through Berkefeld N and W filters (Cox[31]).

The more recent developments in the field of cultivation by *in vitro* and *in vivo* methods of the rickettsiae of endemic and European typhus, of Rocky Mountain spotted fever, and of "Q" fever and Nine Mile fever have afforded a means for accurately studying the morphology of the organisms. It has been possible to obtain almost pure suspensions of rickettsiae by the method of differential centrifugation and protein precipitation, using material rich in rickettsiae. In such suspensions, freed from tissue, and in Maitland media cultures where the rickettsiae are found free to a large extent, the morphology is definitely bacillary.

The rickettsiae of endemic and European typhus, of Rocky Mountain spotted fever, and of Nine Mile and "Q" fever when seen in the cytoplasm of cells are scattered about, when few in number, and do not form groups or colonies. It appears that they are free to move about, though they may finally multiply to such an extent that they completely fill the cytoplasm. With Giemsa stain there is a uniform staining of all the elements. Multiplication apparently occurs by binary fission. In contrast the trachoma bodies form a circumscribed mass known as the "inclusion body." This very often takes the form of a crescent-shaped cap adjacent to the nucleus. In some cases there may be two or more of these caps. The inclusion body may also be irregular in form and not necessarily close to the nucleus.

The striking feature of the inclusion body is the differential staining with Giemsa at the beginning of the appearance of the "elementary bodies." The latter stain reddish and occur as very small cocci embedded in a blue-staining matrix. As a result of the study of a large number of preparations from trachoma cases in which inclusion bodies were seen in many stages the writer[32] has expressed the opinion that the inclusion body in the early stages consists of elongated or rodshaped organisms (initial bodies" of Lindner). These are of indefinite outline and stain bluish. Later these bodies appear to coalesce and to become less dense, forming the bluish "Mantle" or matrix in which the small coccoidal "elementary bodies" are embedded. As shown by Rice[33] the matrix contains a carbohydrate, probably glycogen. The early stage of inclusion body, when it consists of the comparatively few larger bodies, is rarely seen; the

inclusion body in the "elementary-body" stage is the usual form. The elementary bodies appear, therefore, to be the typical form of the organism. They are definitely round and uniform in size though small.

The evolution of the inclusion body of trachoma may be described as a "developmental cycle," a term used by Bedson and Bland[34] to describe the change in the appearance of the psittacosis bodies. In the opinion of the writer the early stage of the psittacosis organism is more definitely round than is the case in trachoma. Also, the "developmental cycle" seems to be even more pronounced in trachoma than in psittacosis.

The differences in the morphology of the typical forms of the true rickettsiae and of the elementary bodies in trachoma as well as the absence of a matrix and differential staining by Giemsa in the case of rickettsiae, and the more complicated growth cycle in trachoma would appear to differentiate the bodies found in trachoma from the rickettsiae. Further light may be thrown on the subject, however, when we have succeeded in obtaining sufficient amounts of trachoma elementary bodies by *in vivo* or *in vitro* methods, so that more detailed studies may be made.

The Weil-Felix test. In order to determine the status of the Weil-Felix test in trachoma in this country, I have tested 100 serums, 80 from trachomatous whites and 20 from trachomatous Indians. Fifty-seven of the serums from whites were from patients being treated at the Irvine-McDowell Memorial Hospital for treatment of trachoma in Richmond, Kentucky, and 23 from patients at the Trachoma Hospital of the State of Missouri located at Rolla, Missouri. The 20 from the Indians were from school children in the states of Nevada, California, and Arizona.

Among the cases in whites: 9 were early cases of from 2 to 8 months' duration; 9 were cases from 1 to 2 years' duration; 12 were cases from 3 to 5 years' duration; 18 were cases from 6 to 10 years' duration; 12 were cases from 11 to 15 years' duration; 9 were cases from 16 to 20 years' duration; 5 were cases from 21 to 25 years' duration; 3 were cases from 26 to 30 years' duration; 3 were cases from 31 to 35 years' duration.

Information as to duration of the disease in the Indians was not available.

Clinically the cases were classified as follows: 7 Macallan's Trachoma Stage I; 27 Macallan's Trachoma Stage IIa; 7 Macallan's Trachoma Stage IIb; 52 Macallan's Trachoma Stage III; 7 Macallan's Trachoma Stage IV.

The antigens employed were OX-19, OX-2, OX-K and Noury's Proteus TrN. Eighteen specimens were also tested against a *Brucella tularense* antigen. Tests were made with dilutions of the sera ranging from 1:10 to 1:1,280.

As controls in the 100 serums from trachomatous patients, the same tests were made with 55 serums received for Wassermann testing for syphillis. Of these six were positive (2, four plus; 2, three plus; 2, one plus).

A comparison of the results obtained with the trachoma serums and the normal serums shows no significant differences. Occasionally positive agglutinations in dilution of 1:40 or 1:80 were obtained with the trachoma serums but this was true also of the normal serums. The usual type of reaction in the case of the serums from trachomatous whites was incomplete agglutination, indicated by two plus in a dilution of 1:10 or occasionally three plus, and a trace in dilutions 1:40 and 1:80. Many showed no trace of agglutination in any dilution and this was particularly true in the tests against antigens OX-2 and OX-K.

Among the Indians, more definite agglutinations were obtained against antigens OX-19 and TrN. Six of the 20 serums agglutinated OX-19 in dilutions ranging from 1:40 to 1:80 (one at 1:160 —three plus). Against TrN antigen, five agglutinated in dilutions 1:40 to 1:80. In a number of these, the zone phenomenon was quite noticeable, agglutination being indicated by one plus in dilutions 1:10, 1:20, with two plus or three plus in dilutions 1:40, 1:80.

On the whole, the results may be considered negative, for in only one case was the agglutination titer over 1:100. There was no evidence to indicate that the test would be of any value in the diagnosis of the disease.

In contrast, diagnostic value of the test in typhus fever, for example, is indicated by the very high percentage of positive and the high agglutination titers reached. In the control series of typhus cases cited by Poleff and Nain, a positive Weil-Felix test was obtained in all of the 821 cases of European typhus and four cases of murine typhus. Titers reaching 1:10,000 or higher have been encountered in our tests at the National Institute of Health.

Agglutination tests with suspensions of rickettsiae. In response to the suggestion by Cuénod and Nataf that the "rickettsiae" of trachoma might be identical with *R. Rocha-Limae,* Weigl[11] tested trachoma serums against this organism and also against *R. Prowazeki,* with negative results in both cases, as well as against Proteus OX-19 and OX-K.

Supplementing the results of Weigl it seemed desirable to the present writer to carry out agglutination tests with trachoma serums against other rickettsial suspensions. Accordingly, suspensions were prepared, using the Wilmington strain of endemic typhus, a "Q"-fever strain obtained from Burnet,[28] and the X strain of Nine Mile fever.[29] The latter two are filterable and might seem more closely related in that respect to trachoma than are the typhus rickettsiae.

Suspensions of the typhus rickettsiae were prepared from infected mouse lungs according to the method of intransanasal inoculation of Castaneda,[30] the Nine Mile fever from infected mouse spleens, and the "Q" fever from infected mouse spleens and livers according to the method of Burnet and Freman.[28] A 10-percent suspension of tissue ground with alundum was centrifuged in the horizontal centrifuge at 2,800 r.p.m. for 15 minutes. The supernatant fluid was centrifuged in the angle centrifuge at 10,000 r.p.m. for 45 minutes, and the precipitate suspended in 1-percent saline, which was adjusted to a reaction of pH 4.8 to 5 by the addition of glacial acetic acid (method of Leon[35]). The proteins were readily precipitated by centrifugation at low speed, the supernatant fluid being a nearly pure suspension of rickettsiae with very little tissue.

Twelve of the trachoma serums were tested in dilutions of 1:10, 1:20, and 1:40 against the suspensions of the three rickettsiae. No trace of agglutination was obtained in any, while control immune sera gave definite agglutinations against their corresponding antigens. A "Q"-fever rabbit serum agglutinated both the "Q" and the Nine Mile antigens in a dilution of 1:320 (+++), while three mouse serums and two human serums gave positive tests in dilutions of 1:10 and 1:20. Two typhus control sera agglutinated the typhus suspension in dilutions of 1:320 (++).

The results were, therefore, very definite. There was no agglutination with any of the three antigens tested and, therefore, no evidence of antigenic relationship by this test.

Discussion and comment

The question as to the rickettsial nature of trachoma is rather the question,

"What are rickettsiae?" Considering as criteria small bacillary bodies requiring Giemsa stain for demonstration, intracellular habitat, an arthropod host, and failure to grow on artificial culture media, it is questionable whether the organism of trachoma could be included on this basis. Contradictory results have been reported by different workers concerning the possibility of growth of the trachoma virus in the intestinal tract of the louse, and further experimental evidence seems necessary before this can be accepted. It must be certain that lice do not already harbor rickettsiae that may be confused with other organisms that may be introduced.

The matter of an arthropod host has, however, not always been given consideration in the classification of certain small bodies requiring Giemsa stain for demonstration, as is notably true in the case of psittacosis (Lillie[36]). Whether the definition of rickettsiae should be broadened to exclude this as a criterion is a question.

As to louse transmission in general, it may be remarked that transmission through the use of the common towel and wash basin and the long chronicity of the disease with repeated exacerbation explain the continued viability of the virus without the necessity for an intermediary host, though it is possible that the louse might be an accessory factor.

A positive Weil-Felix test was not originally considered a criterion for the classification of a disease in the rickettsial group. Though the test is positive in most of the human rickettsial diseases, there is some doubt in regard to trench fever and the "Q" or Nine Mile fever. Also in certain conditions in animals in which rickettsia or rickettsialike organisms have been described, such as heart water and a conjunctivitis of sheep, a positive Weil-Felix test has not been reported. However, regardless of whether the Weil-Felix test should be considered a criterion, the completely negative results in our tests as well as in those of certain others indicate that the test cannot be considered of diagnostic value.

The results obtained by those who report positive results also are not striking. Roughly, in some reports two thirds of the cases diagnosed as trachoma clinically were positive by the test and one third negative. In certain normal controls reported, one third or more gave a positive test and two thirds or less were negative. For early diagnosis, which is of most importance, the test would be of less significance than are clinical symptoms.

On the basis of morphological appearance and growth characteristics in the cell, the inclusion body of trachoma appears to be rather distinct from the rickettsiae. Inclusion bodies have been quite generally accepted as evidence of "filterable viruses." The elementary bodies of trachoma are filterable. Most of the rickettsiae are nonfilterable, but this criterion breaks down in the case of the recently discovered rickettsiae of Nine Mile and "Q" fever, which are filterable; this further emphasizes the difficulty of distinguishing between rickettsiae and filterable viruses, the two, however, forming a group entirely distinct from the bacteria.

The more complicated "developmental cycle" in the case of the trachoma inclusion body, the presence of the matrix, with differential staining by Giemsa is perhaps the most distinctive difference between it and the generally accepted rickettsiae.

Whether the very numerous faintly staining bodies, seen by Cuénod and Nataf and others in the follicles of trachoma, which are stated to occur in the cells, between the cells, and in protoplasmic fragments ("plastilles") are certainly organisms is questionable. The

claim that they are rickettsiae indicates definite staining by Giemsa, but since Giemsa has been widely used in the staining of trachoma specimens since the time of von Prowaczek and Halberstaedter, it is difficult to understand why these bodies have not been seen by many other workers.

The cultivation experiments by Poleff and by Cuénod and Nataf are of great interest and, if confirmed by other workers, may lead to further elucidation of the problem.

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BENIGN MELANOMAS OF THE CHOROID AND THEIR MALIGNANT TRANSFORMATION*

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Benign melanomas of the choroid occur much more frequently than one is led to believe from a review of the ophthalmic literature. It would seem from reported cases that malignant melanotic tumors of the choroid are more frequent than are benign tumors. Schappert-Kimmyser[1] investigated histologically the occurrence of benign melanomas in eyes with and without sarcomas. She found 5 separate benign melanomas in 50 sarcomatous eyes, and 2 benign melanomas in 50 nonsarcomatous eyes. With reference to the relative frequency of melanomas and melanosarcomas she quoted Kraupa as stating that in six years he had observed 10 benign melanomas and had removed five eyes for melanosarcoma. Wagener and Wellbrock[2] estimated that benign melanomas were seen at least once in every 100 patients without complaints referable to the eyes. We detected benign melanomas 26 times in 2,300 cases or once in every 88 patients, while we have removed only one eye from this same group for melanoepithelioma of the choroid. According to Friedenwald,[3] malignant melanotic tumors within the eye occur in about 5 of 10,000 patients seen in eye clinics while Stallard[4] found that sarcoma or malignant melanotic tumors occurred once in every 4,000 patients seen at the Moorfield's Eye Hospital between 1925 and 1931. It is, therefore, quite evident that benign melanotic tumors of the choroid are much more frequent than are malignant melanomas of the uveal tract.

The ophthalmoscopic appearance of benign melanoma of the choroid has been described by Moore,[5] Suker,[6] and Johnson.[7] The appearance of these tumors is so striking that they cannot be mistaken for any other lesion when once seen. The contrast between these lesions and the surrounding fundus is not marked, however, so that they may be

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easily overlooked in hurried ophthalmoscopic study of the fundus. Often the variously described slate-gray to "blue ointment" appearance is first seen as a dark spot by reflected light. Benign melanomas are usually seen in the posterior half of the fundus, are oval or circular in outline, and vary from one-half to four disc diameters in size. The edges of the lesion are usually quite definite everywhere and do not shade off into the surrounding fundus. There is no marginal pigment disturbance or light fringe. There is no measurable retinal elevation over the lesion, and the choroidal pattern can be seen well around, but not over the tumor. These benign tumors are single but may be multiple. In one of my own cases, two of these lesions were seen widely separated on opposite sides of the fundus. The "blue ointment" (Moore) appearance describes most of them satisfactorily.

Efforts to find field defects corresponding to these benign tumors were of no avail in eight of my cases, and none of my cases had any symptoms referable to the eye.

The histological appearance of a benign melanoma of the choroid has been described by Moore,[5] Usher,[8] Johnson,[7] Parsons,[9] and others. They agree that a melanoma is essentially a congenital abnormal, circumscribed accumulation of closely packed chromatophores and epithelial cells producing a uniform dense pigmentation in the outer layers of the choroid. In the center of the lesion the cells are spindle shaped, with the long axis in the plane of the retina, while in the periphery they are more round. The cells are densely pigmented, more massive than normal, but the nuclei can be seen fairly well. There is no extracellular pigment. The choriocapillaris is not involved, and the whole width of the choroid is usually increased at the site of the lesion. The pigment epithelium of the retina is always normal. Velhagen[10] called attention to the spindle-shaped bodies of the cells, and to the fact that they differ from the normal pigment cells of the choroid in that they have no processes or very short ones.

It is my belief that benign melanomas of the choroid are analogous to pigmented nevi of the skin. The nature and ontogeny of these tumor cells has led to considerable controversy and considerable difference of opinion. Schappert-Kimmyser and Houwer[11] believed these cells to be of mesodermal origin. This view was also held by Mann[12] and many others; Collins,[13] however, thought them to be of both ectodermal and mesodermal origin. Spencer,[14] Knight,[15] and Dawson[16] believed these cells to be of epithelial origin. Wagener and Wellbrock[2] believed that pigmented nevi of the choroid consist in part of pigmented chromatophores and in part of epithelial cells that are apparently derived from the pigmented epithelium of the external layer of the secondary optic vesicle by a process of splitting-off during the ingrowth of the vascular tissues of the choroid. It remained for Masson[17] to show that these tumors are neither ectodermal nor mesodermal, but neuroectodermal and associated with the terminal neuro apparatus. He believes that all pigment-forming cells are of nervous origin. Dvorak-Theobald[18] also believed that melanomas are of neural origin.

The possible malignant transformation of benign melanomas of the choroid has been suggested by de Schweinitz and Shumway,[19] Wolfrum,[20] Moore,[5] Heine,[21] Dawson,[16] and Houwer.[22] Dvorak-Theobald[18] stated that benign melanomas generally become highly malignant. None of these authors, however, were able to give definite proof of the transformation. Wagener and Well-

brock[2] observed a case in which a malignant melanoma arose at the site of a previously benign tumor. Histologically the malignant tumor was found to have its origin in the malignant transformation of the cells in the central portion of a preëxisting benign melanoma.

Case report

In the course of an examination of the eye of a patient with an intraocular tumor, she gave the history of having been examined eight years previously by a physician. A patch of slate-gray pigment had been observed in the eye at that time, and the patient was told that she had a congenital pigment spot in the eye. It is believed that a malignant melanotic tumor arose from a previously existing benign lesion in the case.

A woman, 60 years of age, came to the Christie Clinic on February 28, 1936, complaining of dizziness, headache, redness, and intense pain in the left eye. She stated that the vision had always been poor in that eye, because the eye had squinted when she was a child. There had also been some scars on the cornea of the left eye since birth. Eight years previously she had been examined by a physician, now dead, who also refracted her but could not improve her vision in the left eye more than to enable her to read the big "E" on the chart. At that time an ophthalmoscopic examination was made, and the patient was told that there was a spot of slate-gray pigment in the upper part of the retina. The patient stated that the doctor described it as similar to a pigment spot on the skin. There were no symptoms referable to this eye except poor vision. Eight months previous to admission, the vision had begun to diminish, and four months previous to admission, it was completely lost. Not long after the vision was lost, the eye became periodically red but never painful, until two weeks previous to admission, when the eye became very red and increasingly painful. The pain became so intense that the patient had not slept for the last four days before coming to the clinic.

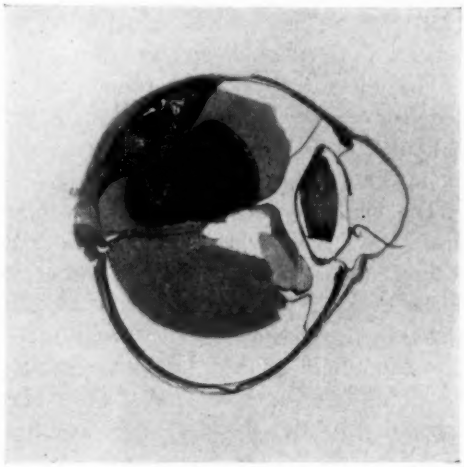

Fig. 1 (Albers). Cross-section of the eye showing the general appearance of the tumor.

Ocular examination: The vision in the right eye was 20/20 with glasses. The patient could read J. 0.50 print well with her glasses. The examination of this eye was entirely negative. The vision in the left eye was light perception in the temporal field. The lids were slightly swollen and red. The conjunctiva of the lids was moderately injected, while that of the globe was markedly injected. No masses could be felt in the orbit. The lower canaliculus had been previously slit for chronic dacryocystitis, and there was a small amount of pus in the lacrimal sac. The cornea was very steamy, and a few faint scars could be made out over the apex. The anterior chamber was shallow, the iris hyperemic, and the vessels of the iris were markedly dilated. The pupil measured 5 mm. in diameter and did not react to light; the lens was hazy. The fundus could not be seen be-

cause of the steamy cornea. The tension measured 80 mm. Hg (Schiötz). The upper half of the eye did not transilluminate.

A diagnosis of intraocular tumor with secondary glaucoma was made, and an enucleation was performed on March 2, 1936. At the time of the enucleation no masses were palpable in the orbit.

The general physical examination was negative. Several years previously the patient had had a cholecystectomy and an appendectomy.

The patient remained perfectly well until May, 1938, when she began to lose weight and appetite. She had vomiting spells every few days. At that time she also noted a yellowish discoloration of the skin, slight at first, but progressively becoming worse. Her stools were clay colored. In July, she developed swelling of the legs which progressed up the thighs to her abdomen.

The physical examination revealed a large nodular liver, and a diagnosis of metastatic carcinoma of the liver with secondary portal obstruction was made. The patient died on July 22, 1938. Unfortunately, no autopsy was obtained.

Pathological report: The eye was examined by Dr. Edith Parkhill of the Mayo Clinic, who kindly submitted the following report:

Gross Description: The eyeball is of about normal size, but slightly squared in shape. Measurements: Transverse 24.2 mm.; vertical 23.1 mm.; anterior-posterior 23.1 mm. The cornea is clear. The iris is grayish, and the pupil round (3.8 mm. in diameter). The sclera bulges slightly between the rectus muscles. The eye was sectioned vertically at the corneal margins. The iris is pushed forward; the anterior chamber is shallow. The lens is in place. Superiorly, rising from the choroid, is a solid purplish-brown tumor, 10 mm. in diameter. The retina is detached and lies in folds near the axis. Between the retina and the choroid is a solid, tough, gelatinous, brownish, homogeneous substance (solidified subretinal exudate). The optic disc is not visible. The optic nerve has been cut close.

The tumor is of "mushroom" shape, with a lentiform base, 12 by 3 mm., which lies in the choroid, and an irregular spheroidal "cap," 1 cm. in diameter, extending inward to the center of the eye and connected with the choroidal portion at the level of the lamina vitrea by a relatively narrow neck.

Microscopic Description: Near the center of the choroidal portion of the tumor is an irregular mass about 3 mm. in diameter, of clear, granular, hyaline, eosinophilic material in which is scattered melanin pigment arranged in fine spindle-shaped lines and in larger, heavier, irregular clumps. No cells or cell nuclei can be made out in this area, which appears to be an old degenerated portion of the tumor. At the periphery of this area is a narrow, irregular, heavily pigmented layer, apparently consisting of large polyhedral cells so densely packed with pigment that no cell structure can be seen. Surrounding this are whorls of small spindle-shaped cells with ovoid or spindle-shaped nuclei and small nucleoli. At the periphery, posteriorly, is an area of extensive fibrosis, interspersed with pigmented cells which also give the appearance of having been present for a long period. The inner spherical younger portion of the tumor is made up, for the most part, of somewhat larger cells, not only spindle shaped, but also ovoid and spheroid with more hyperchromatic nuclei and larger nucleoli. In this portion of the tumor are numerous relatively large blood spaces.

Pathologic Diagnosis: Melanoepithelioma of the choroid.

Conclusions

It is quite evident that benign melanomas of the choroid are much more frequent than they were previously thought to be, occurring about once in 88 patients without complaints referable to the eye. Clinically a malignant melanoepithelioma is thought to have risen at the site of a previously benign tumor observed eight years previously on routine fundus examination. It is thought that melanomas as seen in the eye are usually benign, but that they may become highly malignant. Melanomas in the eye, once diagnosed, should be carefully watched for growth, which may be recognized by stippling or irregular pigmentation over the tumor. Should signs of growth become manifest, the eye should be immediately enucleated, for once the tumor gets so large that secondary glaucoma results, enucleation will usually not prevent early death of the patient from metastasis.

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THE BIOCHEMISTRY OF THE LENS: A RÉSUMÉ*

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As information concerning the chemistry of the crystalline lens has accumulated, an effort has been made from time to time to sift, summarize, and interpret the significant data.[1-11] In attempting such an analysis the task is to distinguish the true from the false, the probable from the improbable, and to replace, if possible, confusion by order, discredited theories by more plausible concepts.

It is only within recent years that an intimate knowledge of the lens has developed. The trail-blazing contributions were: On the growth of the lens by Priestley Smith (1881); Production of naphthalene cataract by Bouchard and Charen (1886); Classification of lens proteins by Mörner (1894); Immunologic characteristics of lens by Uhlenhuth (1906); Mineral changes in cataract by Burge (1909); Lenticular autolysis by Clapp (1911); Loss of sulfhydril reaction in cataract by Reis (1912). Modern research has elaborated these investigations and probed the respiration and metabolism of the lens, the vitamin content, the sensitiveness to certain poisons, nutritional deficiencies, and endocrine disturbances, and amassed also a wealth of physico-chemical data.

MAJOR CONSTITUENTS

Considering only its major constituents, the lens consists roughly of one-third protein and two-thirds water—a concentration of protein above other tissues. In relation to dry weight, the proportion of water is two to one in the cortex; one to one in the nucleus. The mineral ash varies with the water ratio, and is 2.6 percent of the dry weight in the cortex; 1.3 percent thereof in the nucleus. The protein complex, christened "crystallin" by Berzelius, was separated by Mörner into its components; namely, a water-insoluble "albumoid," and water-soluble alpha crystallin, beta crystallin, and albumin. The albumin fraction, which composes but 1 to 2 percent of the protein in mammalian lenses, comprises over one third of the protein of the fish lens,[12] and would be appropriately termed "gamma crystallin" as Woods[3] suggests. Albumoid seems to be chemically a modification of globulin, but in its physical character resembles albuminoids, such as collagen. The crystallins behave like pseudo-globulins in solubility, but the high content of di-amino acids and the absence of glycine suggest a chemical relationship to the albumins.[2] The sulphur content of beta crystallin is 1.3 percent, twice that of alpha crystallin; albumoid has an intermediate quantity, but unlike them does not react to the sulfhydril test.

Lens substance is not antigenic to the homologous species, except when sensitized by staphylococcus toxin, which apparently explains the mechanism of endophthalmitis phaco-anaphylactica.[13] But if mammalian lens substance is injected in another species, precipitins are produced which are effective against the lenses of all vertebrates except fish. The antiserum produced by fish-lens antigen, however, will react with every lens extract of the vertebrate kingdom.[14] Alpha and beta crystallins are immunologically

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distinct, but the antiserum excited by albumoid precipitates alpha crystallin, a significant evidence of their chemical relationship.[3] The administration of lens protein to cataract patients in the belief that the anibodies developed would act selectively on decomposed lens fibers appears to be unwarranted, as all antibodies are associated with globulins and hence could not enter the aqueous and the lens capsule. The procedure has been revived, fish lens antigen[12] being used, but the results if substantiated may be due to some special peculiarity of fish-lens protein.

Growth of the lens

After the juvenile velocity of growth has passed, the human lens adds each year 1.5 mg. of weight, 1.15 cu. mm. of volume. The specific gravity changes from 1.034 at the age of 20 years to 1.113 at the age of 90 (Scammon and Hesdorffer[15]). Morphological changes in the growing lens are accompanied by quantitative changes in its chemical constituents. With increasing years, an absolute increase of protein and lipid is associated with a proportional loss of water, and a progressive change in the percentage of water-soluble and water-insoluble proteins. However, the soluble crystallins increase in direct proportion to the increase in lens surface, while the metabolically inactive albumoid accumulates in proportion to the square of the lens weight.[16] Thus the relative proportion of albumoid steadily mounts. The lens of a five-week calf weighing 0.9 gm. contains 7 percent albumoid; that of a 16-year-old cow weighing 2.7 gm., contains 21 percent. The new lens fiber is predominantly composed of soluble crystallins. As the fiber ages the proportions of albumin and beta crystallin are only slightly altered, but alpha crystallin is gradually converted into albumoid. In the lens from a year-old steer, albumoid composes but .004 of the protein of the subcapsular cortex, but is nearly 40 percent of the nuclear protein,[9] while the variation in beta crystallin is only from a little more to a little less than 50 percent.

The total lipids which represent 2 percent dried weight of human infant lenses attain 8 percent dried weight in the eighth decade. During this period the proportion of mineral ash rises by 28 percent, and as the increase principally affects phosphorus, it is probably a sequence of the lipid accumulation.

Metabolism

The lens, depending entirely on the aqueous for its metabolic interchange, keeps alive under precarious conditions. The possible assistance of an intrinsic autoöxidation mechanism has intrigued the imagination of investigators for the past 25 years. Reversible oxidizing-reducing substances were found in the successive discoveries of glutathione and vitamin C, each in a relative concentration in the lens greater than in other tissues. According to modern figures, per 100 gm. rabbit lens, glutathione averages 125 mg., vitamin C 30 mg., vitamin C accounting for 30 percent of the total reducing power. A linked chain has been pictured in which oxidized cevitamic acid is reduced by glutathione, and oxidized glutathione in turn reduced by beta crystallin. The disappearance of the reducing system as a cataract advanced suggested that the service rendered was interwoven somehow with the life of the lens, but in what way has baffled demonstration. Reduction may be involved in various essential enzymic operations, for it has been shown that arginase and kathepsin can be thus activated.

The lens subsists on carbohydrate only as indicated by its respiratory quotient.

More dextrose is available than oxygen to consume it, so that the major part of dextrose metabolism does not go beyond the anerobic stage—the excess lactic acid diffusing into the aqueous. The aqueous from an aphakic eye contains but half the lactic acid normally present.[17]

The anerobic phase of dextrose metabolism ending in the formation of lactic acid has been labeled glycolysis in contrast to the aerobic phase, termed respiration, in which lactic acid is oxidized finally to carbon dioxide. In the incipient stage of the cataracts produced experimentally, either by naphthalene[18] or parathyroidectomy,[19] glycolysis is constantly and markedly reduced, while oxgyen consumption still remains unchanged. As the cataract becomes total, both processes are abolished. Glycolysis in the lens parallels the complicated process studied in muscle.[20] A preliminary prerequisite to glycolysis is the interaction of phosphocreatine with adenylic acid in the presence of magnesium to produce adenylpyrophosphoric acid. The hexose-phosphates then formed are involved in a series of degradations ending in pyruvic and lactic acids. Vitamin B-1 (thiamin) is present in the normal lens but not in cataract.[21] The amount is almost infinitesimal, 0.000001 mg. per lens, but essential, for without it the breakdown does not advance beyond the pyruvic-acid stage.* The pyruvic-acid content of cataracts varies with their maturity, and is 20 to 100 times that of normal lenses.

The lactic acid that undergoes aerobic oxidation requires also the mediation of enzymes and catalysts in its successive breakdowns, including a special dehydrogenase, the flavin enzyme, composed of riboflavin, phosphoric acid, and protein. In the series of modifications that ensue, pyruvic, succinic, fumaric, malic, oxaloacetic, and formic acids have been identified.[22] Citric acid is also present but the mechanism of its formation is not understood.** Glycogen is absent, but inositol may function as a stable metabolite in its stead, and as it exists partly bound with phosphorus possibly acts also as a phosphorus carrier.

The healthy lens contains the vitamins A, B-1, B-2, nicotinic acid,*** and C. Its fluorescence is partly due to B-2, otherwise known as riboflavin or lactoflavin. The absolute absence of riboflavin from the diet of rats just weaned produces cataracts in two to three months; however, with an allowance of as little as 30 micrograms per week, alopecia and keratitis ensue but very few cataracts. Incipient cataracts thus originating can be arrested by the intramuscular injection of 120 micrograms of riboflavin twice weekly.[23]

The concentration of vitamin C in the lens depends considerably on the animal's diet, being 10 to 15 times as great in sea fish and herbivora as in carnivora, such as the dog or cat. Cevitamic acid manifests three variations. Exposed to the air, it becomes irreversibly oxidized and inactive. The blood and spinal fluid of man contain 1 to 2 mg. per 100 c.c. of the reversible oxidized form, but the aqueous and lens possess only the re-

* In attacking pyruvic acid, phosphorylated thiamin acts as a coenzyme in splitting off CO_2 from the COOH radical (decarboxylation).

** H. A. Krebs believes that oxaloacetate combines with an oxide of triose to form citric acid which in turn is oxidized to succinate.

*** The tissues burn hydrogen, not carbon. Carbon dioxide results, not from oxidation, but from decarboxylation. The removal of hydrogen from the molecule, dehydrogenation, is performed by specific enzymes. With the exception of succinodehydrogenase, all dehydrogenases involved in respiration need a coenzyme containing *nicotinic acid amide* (Szent-Györgyi, A. Mechanism of biological oxidation. Proc. Inst. of Med. of Chicago, 1939, v. 12, p. 418).

duced variation, and to the extent of 12 mg. and 30 mg. per 100 gm., respectively. The lens derives its vitamin C from the blood, reduces it, and the reduced form accumulates in the aqueous and lens, since the capillaries of the blood-aqueous barrier are relatively impermeable to this alteration.[24] When capillary permeability is increased, as in uveitis and after subconjunctival injection of hypertonic saline, the titer in the aqueous falls to the low level of 3 mg. per 100 c.c.[25]

The lens capsule

The capsule of the lens is a fairly inert membrane, very resistant to physical, chemical, and pathological influences. Its permeability is greater than that of the capillaries, and colloid particles too large to pass the blood-aqueous barrier may still diffuse through the isolated lens capsule. The capsule is impenetrable to fat, but otherwise the only factor limiting permeability is molecular size. In the lens of the living animal the penetration of a variety of substances has been demonstrated; for example, alcohol, sodium salicylate,[26] and dinitrophenol[27]—given orally; sodium iodide and vitamin C—after instillation; and fluorescein—following parenteral injection.

As with all tissues the lens capsule tends to become decreasingly permeable with age. In this and some other aspects cataract simulates the aging process. Recent experiments on lens capsules affected by the newer cataract-producing agents, dinitrophenol[27] and galactose,[28] show either no change or a reduced permeability, confirming the similar conclusions of previous investigators.[26, 29] An increased permeability in lens cells, however, is evidenced by a change in the mineral composition of the cataractous lens in the direction of that characteristic of the aqueous.

Changes in cataract

The cataractous lens is not only dead but in the process of dissolution. Irrespective of primary cause, similar physical and chemical sequences ensue, all directly or indirectly due to autolysis. As a cataract advances, a transient slight dehydration is followed in turn by marked hydration and subsequent resorption. A progressive loss of solids determines a loss in total weight—transparent human lenses averaging 227 mg., opaque lenses, 183 mg. (Clausnizer[30]). Cataract is characterized by a loss in glycolytic and respiratory activity, accompanied or followed by a *loss* of vitamin content, glutathione, soluble crystallins, nitrogen, and potassium; and an *increase* of sodium, calcium, amino-acids, peptones, and fatty acids. Cholesterol, like albumoid, is not destroyed by autolysis, and though the polariscope often reveals myelinlike, birefractive substances in cataract, cholesterol does not actually accumulate, but its presence is merely unmasked by the lipid disintegration. In lipid analysis of normal lenses, the proportions of lecithin, cholesterol, and fat are about equal. As a cataract matures the cholesterol content remains unaffected but the phospholipids decrease, and fat accumulates from their breakdown (Salit[31]).

In cataract the close parallelism in the loss of potassium and nitrogen indicates that both in common are derived from protein destruction.[16] The calcium gain follows inversely the nitrogen loss, and is deposited partly as a result of diminished respiration, partly from interaction with liberated fatty acid, phosphate, and sulphate ions. The gain in sodium merely effects an osmotic compensation for the loss of potassium.[16]

The water changes are explainable as a result of processes conditioning or evolving from autolysis. The imbibitional

power of protein is principally modified by aging, pH, electrolytes, and proteolysis. The pH of the normal lens is 7.4; its isoelectric point where imbibition is at its minimum is pH 5.16. Consequently, the first effect of acidification, which is a necessary prerequisite for autolysis, is dehydration. When glycolysis is incomplete and respiration inadequate, organic acids accumulate and convert the otherwise immune base protein into available substratum for the primary autolytic protease. As autolysis shortens the protein chains, the imbibitional power of the lens is lessened; but the osmotic pressure is increased since more particles are produced; and the hydration stage thus results. Characteristic of this phase are water vacuoles between the cells, accumulation of water beneath the capsule, and water-splitting of the sutures. The fact that in lenticular autolysis there is no longer the normal balance between osmosis and imbibition—in that an increased osmosis accompanies a lessening of imbibitional power—provides the probable explanation of these findings. Owing to the aging effect on protein, old lenses possess less imbibitional capacity than do young lenses, and so are more inclined to such accumulations of unabsorbed water.

The isoelectric point of beta crystallin is pH 6.0; of alpha crystallin, pH 4.8. Accordingly, it requires but a slight acid shift to convert beta crystallin into acid protein and so render it susceptible to autolysis. In support of this view it has been demonstrated *in vitro*[7] and *in vivo*[32] that in lenticular autolysis the disappearance of beta crystallin precedes that of alpha. Alpha crystallin, by buffering the local acidosis, should tend to protect beta crystallin from autolytic attack. With increasing age alpha crystallin decreases in the lens, and this decrease possibly accounts for the special susceptibility of the aged to cataract.

Though beta crystallin is almost evenly distributed throughout the lens, alpha crystallin decreases markedly from cortex to nucleus. Hence, if the foregoing reasoning is valid, the nucleus should be the more susceptible to acidic agents and consequent autolysis. Because of its density and central position, diffusion into the nucleus is slow,[26] and it could be reached by a powerful disturbing agent only after the cortex had succumbed to attack. Being more viable, however, the cortex could withstand a weak disturbance, which would then go on to assail the nucleus. By varying the intensity of naphthalene poisoning, Goldmann[33] was thus able to produce cortical and nuclear types of cataract. Mineral analyses indicate that in the cataracts that ordinarily come to operation, cortex and nucleus are diffusely involved in the degenerative process.[34] Salit[35] has demonstrated that nuclear sclerosis, like cortical cataract, is due to autolysis and is characteristically accompanied by hydration and loss of solids. The breakdown in nuclear sclerosis affects the lipid complexes, which, with beta crystallin, seem the weakest units in the cellular defense.

Oxidizing agents intensify the clouding effect of acid on lens proteins so that *in vitro* Nordmann and Reiss[36] were able to produce a maximum opacity at pH 6.5. The glutathione-cevitamic-acid system, by keeping the oxidation-reduction potential down, may thus exercise a significant protective power, which, however, would be lost at pH 7.0 when the reducing power of the human lens disappears. The platinum potential of the normal human lens is +87 millivolts, rising in cataract to +166 millivolts. In comparison with the cortex the nucleus has a sluggish metabolism, accompanied by a lessened concentration of glutathione

and cevitamic acid, and a consequently higher potential—factors favoring its susceptibility to noxious influences.

Experimental cataract

Nutritional cataract. Cataracts produced by the total absence of riboflavin or tryptophan from the diet are truly nutritional cataracts. The mechanism of galactose cataract, however, rests primarily on an osmotic basis.[37] Galactose is a readily absorbed, nonfermentable sugar which forms a soluble calcium compound and is only slightly assimilated. In quantities below 15 percent of the diet the lens is not affected, but in concentrations above 25 percent, nuclear cataracts develop in about three weeks in very young rats; cortical cataracts in older ones. Similar lesions are produced by xylose,[38] but not by dextrose, fructose, sucrose, maltose, sorbose, sorbital, or starch. Galactose-fed rats have a high blood calcium, and attain a blood sugar per 100 c.c. of 372 mg., while the highest obtainable with dextrose-fed controls was 121 mg. Other evidences of osmotic effects are polyuria, polydipsia, and a marked ocular hypotony. Increasing the protein of the diet promotes imbibition in blood and tissues and so delays the onset of galactose cataract; whereas decreasing the protein intake has the opposite effect. In young rats the first sign of lenticular disturbance is a subcapsular vacuolated film—an appearance explainable by water withdrawal from the protein mass.[39] As this clears, a posterior opacity is revealed; nuclear and total opacity follow. The increased salt content due to continued dehydration determines protein precipitation. Irreversible flocculation then follows, succeeded by rapid autolysis, marked hydration, and calcium deposition. The germinative epithelium is not primarily affected, and if the galactose ration is replaced by a normal diet before the cataract is far advanced, normal transparent lens fibers are formed which in time compress the opaque portion to a small central area.

Endocrine cataract. The entity of *diabetic* cataract has been proved by animal experimentation.[40] In diabetes the inability of the body to utilize dextrose affects the dextrose metabolism of the lens and also induces an osmotic condition similar to that noted in galactose cataract. A high blood sugar dehydrates the lens nucleus[41]—refractive myopia follows; when the blood sugar is lowered by insulin, the reverse occurs.

In *parathyroidectomy* the primary disturbance is phosphate retention. The increase of phosphate ions is associated with a reciprocal decrease in ionized calcium and a deposition of insoluble calcium phosphate in the tissues. The low calcium brings on tetany and changes in the ectodermal structures—falling hair, brittle nails, affected teeth, and cataract. Similar disturbances occur in rachitic animals when sufficient phosphorus in alkaline form is added to the diet.[42] Cataract and the other trophic disturbances in the ectoderm are uninfluenced by parathyroid hormone therapy.

Radiational cataract. Radium, X rays, and infrared rays produce cataracts of identical type. The youngest cells in the lens as elsewhere are most vulnerable. Fetuses with cataracts have been delivered following X-ray administration for therapeutic abortion.[43] In the growing lens, the susceptible germinative epithelium is attacked, and the axial portion of the fibers, which are furthest from the nuclei, are most affected.[44]

Lens poisons. Cataract has been produced by naphthalene in rabbits, by thallium in rats, by ergot in children, and in susceptible humans of various ages by alpha dinitrophenol, dinitroörthocresol,[45] and paradichlorobenzene.[46] In none of

these instances is the mechanism understood. Naphthalene, excreted in combination with mercapturic acid, draws on the cysteine reserves, but bromobenzene, which acts similarly, does not produce lens changes. Nor do any of the derivatives of naphthalene produce cataract. In dinitrophenol and similar drugs the human lens is somehow affected by the excessive metabolism induced.[47] But why does dinitrophenol produce cataract in man but not in animals, or why does thallium acetate produce in rats cataract, but in man optic atrophy? The answer may be that though mammalian lenses are basically similar, there may still be significant variations in protein configuration among the different species.

Concussion cataract. The vibration of concussion tends to cause a precipitation of protein followed by secondary flocculation. In mild cases the precipitated protein may be repeptized, with a consequent clearing of the opacity. In more severe cases the opacity may be localized for some time, but when the buffering power of the surrounding lens substance becomes no longer capable of combating the acids released by the autolysis there occurring, the opacity spreads to involve finally the entire lens.[48]

Therapeutic conclusions

Misconceptions in the medical management of cataract readily arise from overattention to secondary details. If the primary failure in senile cataract is in the glycolytic mechanism, it avails not to shift the acid-base balance of the diet, nor to administer cysteine, calcium, or potassium. Vitamin depletion must also be classed among incidental manifestations since cataract is not a characteristic accompaniment of xerophthalmia, beriberi, pellagra, or scurvy. Prophylaxis holds a far brighter prospect than cure. The picture of lamellar cataract illustrates that though this complication of rickets with tetany can be arrested by vitamin D and dietetic adjustment the treatment cannot erase whatever cellular degeneration has occurred.

In treating incipient cataract, some physicians endeavor to improve the nutrition of the lens by increasing the permeability of the blood-aqueous barrier through various irritants applied by instillation or by subconjunctival injection. The value of such therapy is theoretically questionable since the metabolic capacity of the lens is limited and the increased permeability withdraws cevitamic acid from the lens and so lessens its reduction power.

The majority of cataracts are of systemic origin, but one eye is often affected while the companion eye is still healthy. If that lens could be kept transparent, the patient would be well content. "One eye is a necessity, two eyes a luxury." It is an encouraging thought that any medicament that can enter the aqueous will diffuse into the lens. The lens could be treated, if we only understood what to use. This we do know, that lental health like mental health depends on the state of the body. 'Lens sana in corpore sano." With our present insight what more can be done than improve the patient's general health, remove focal infections, and correct dietetic and hygienic errors?

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EYE STUDIES FOLLOWING LUMBAR PUNCTURE*

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Investigators in the past have reported various types of reactions following lumbar puncture. The following study was carried out to determine the effects of lumbar puncture upon the intraocular structures, visual acuity, intraocular tension, and blood pressure.

Blood-pressure changes have been noted by several investigators. Enfield and Peterson[1] reviewed the literature and made observations upon 107 patients regarding changes in blood pressure, and found that the effect of lumbar puncture was extremely variable. Kahler[2] found that in 18 out of 20 normal patients there was an immediate drop in blood pressure, while in 29 out of 30 patients with brain disease there was an immediate rise; he further suggests that this behavior of blood pressure might be of diagnostic value.

Postpuncture changes in the ocular mechanism have been recorded by several workers. Fabrigius-Jensen[3] found a decrease in the intraocular tension immediately following lumbar puncture in 16 of the 30 patients studied; there was an increase in tension in 5 patients, and no change in 9. Levy-Valensi *et al*[4] reported two cases of papillary edema following lumbar puncture, the etiology of which he attributed to the reactional hypertension that may follow the withdrawal of spinal fluid. Guillain, Alajouanine and Lagrange[5] found congestion of the disc with dilation of the veins and sometimes even edema in those persons who manifested headache, vomiting, or vertigo following lumbar puncture. They also considered these findings to be a reactional attack of intracranial hypertension

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caused by a compensatory hypersecretion of the choroid plexus subsequent to spinal-fluid drainage.

Material and methods

The material for this study was drawn from patients of the Osawatomie State Hospital who required a spinal-fluid examination for diagnostic purposes. A total of 56 physically healthy individuals were used in the study. Classifications of the patients used were as follows: Schizophrenia 35, mental deficient 8, psychopathic personality 6, manic depressive psychosis 5, syphilitic meningoencephalitis 1, unclassified 1. Ages varied from 16 to 62 years. There were 34 males and 22 females. As a whole, the patients were only mildly psychotic, and coöperated well with the examiner. Those patients with marked reduction in vision, gross eye pathology, or a pupillary diameter of less than 3 mm. were not used in the study.

The procedure was as follows:

1. Visual acuity at 18 inches and at 15 feet was first recorded. The fundus was then examined without the use of a mydriatic. With the patient in the sitting position, the intraocular tension was taken with the Bailliart tonometer, using 0.25-percent pontocaine as an anesthetic. Blood-pressure readings were taken at the beginning of the first phase for the systolic and the end of the fourth phase for the diastolic. The patient retired immediately to bed, where preparation for lumbar puncture was made.

2. The puncture was made with the patient lying on the side. One cubic centimeter of 2-percent novocaine with adrenalin 1:10,000 was used for anesthesia; a 20-gauge spinal needle was used for the puncture. In practically all cases little or no pain seemed to be induced by this procedure. The amount of spinal fluid removed varied from 5 to 10 c.c. Following the puncture the patient rested quietly in bed for two hours.

3. Two hours following the lumbar puncture, the patient walked to the examining room a few steps away, where an examination was made, following the same procedure as outlined above. The patient was then permitted to lie in bed, or to be up in his chair, just as he wished.

4. The same examination as outlined above was repeated at the 4th, 6th, and 24th hours following the lumbar puncture.

Results were tabulated in numerical fashion following each of the various observations. Complaints of the patients were not solicited, but were recorded by the attending nurse, who was instructed to list all symptoms as soon as they were made known.

Results

Effect upon visual acuity: Visual acuity varied to some extent, but as compared to a control group, the fluctuations came well within the range of personal error. In fact, the average change for the entire group was surprisingly constant—a difference of less than one letter on the Snellen chart. Even patients who presented symptoms of intolerance to the spinal puncture showed no consistent change. (See table 1 showing the average change in visual acuity following lumbar puncture.)

Fundus changes and complaints: No change was seen upon ophthalmoscopic examination in 40 of the 56 cases studied. In the other 16 patients hyperemia of the disc was the most common change seen. In most cases it was mild and did not persist, but in some cases it was quite marked and persisted throughout the period of examination. In 13 of the 56 patients this change occurred.

Slight edema of the disc appeared in

TABLE 1

CHANGE IN VISUAL ACUITY FOLLOWING LUMBAR PUNCTURE

Case	Initial Vision				2 Hrs.				4 Hrs.				6 Hrs.				25 Hrs.			
	Near		Far		Near		Far		Near		Far		Near		Far		Near		Far	
	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
1	J1	J1	15/10−4	15/10−6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	J4	J4	15/30+1	15/30	0	0	−3*	−4	0	0	−2	−4	0	0	−4	−4	0	0	−4	−4
3	J1	J1	15/10−4	15/10−1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	J1	J0	15/10−5	15/100	0	+1†	0	0	0	+1	0	0	0	+2	0	+2	0	+2	0	0
5	J0	J0	15/20−3	15/15−3	0	0	0	−1	0	0	0	−1	0	0	0	−1	0	0	+1	0
(File Complete to 56 Cases)															0					
56	J1	J1	15/15+5	15/15+4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Total Change		+22		−12		0		−20		+7		−33		+25		+10	
			Average Change		+0.2		−0.1		0		−0.2		+0.05		−0.3		+0.2		+0.1	

* One unit change indicates an increase or decrease in visual acuity amounting to ½ of the number of letters in any given line of the Snellen Chart; therefore, the −3 indicates a reduction of vision from 15/30+1 to 15/40−2.

† One unit change for near vision indicates an increase or decrease in the patient's ability to read Standard Test Types amounting to one gradation as found on the chart "Standard Test Types Arranged By Dr. Wells." Therefore, the +1 indicates an increase from J0 to J7.

three cases following the lumbar puncture. In one case there were no symptoms, in one case there was a headache, and in the other case there were both nausea and headache. There seemed to be little correlation between symptoms and fundus changes. Hyperemia of the disc was associated with headache in six cases and nausea in one, while in six cases the hyperemia was associated with no symptoms. In most patients, the symptoms were mild. In only one person was the headache severe, and only two patients were nauseated to the point of vomiting. The relationship to symptoms and fundus changes is seen in table 2.

TABLE 2

SHOWING RELATIONSHIP BETWEEN SYMPTOMS AND FUNDUS CHANGES

Symptoms	Changes			
	No Change	Edema	Hyperemia	Total
No symptoms	34	1	6	41
Headache	3	1	6	10
Nausea	2	0	1	3
Headache and nausea	1	1	0	2
Total	40	3	13	

Effects upon intraocular tension:

TABLE 3

SHOWING CHANGE IN INTRAOCULAR TENSION FOLLOWING LUMBAR PUNCTURE

Case	Initial Tension		2 Hrs.		4 Hrs.		6 Hrs.		24 Hrs.	
	R	L	R	L	R	L	R	L	R	L
1	18	22	+ 2	− 5	+ 2	− 5	+ 2	− 7	− 3	− 5
2	17	22	+ 3	− 4	+ 3	− 6	+ 2	− 5	+ 1	+ 3
3	20	18	− 2	0	+ 2	0	+ 2	− 1	+ 4	0
4	20	20	+ 2	− 2	+ 2	+ 2	0	− 3	+ 2	+ 3
5	35	30	+ 3	+ 2	−11	+ 8	+ 3	0	− 3	− 2
(File Complete to 56 Cases)										
56	22	22	+ 6	− 2	− 5	− 5	+ 1	− 5	− 5	− 5
Total	1441	1384	+17	−41	−92	−49	−44	−49	−60	−59
Average	25.8	24.7	+ 0.3	− 0.7	− 1.7	− 0.9	− 0.8	− 0.9	−1.0	−1.0

TABLE 4

INITIAL CHANGE IN BLOOD PRESSURE FOLLOWING LUMBAR PUNCTURE

Case	Blood Pressure		2 Hrs.		4 Hrs.		6 Hrs.		24 Hrs.	
	Systolic	Diastolic	S.	D.	S.	D.	S.	D.	S.	D.
1	124	68	+ 6	−10	−12	− 4	+ 4	+ 2	+ 2	0
2	104	68	− 6	− 6	− 4	− 4	− 4	+ 2	− 2	+ 2
3	102	60	+12	+12	+14	+10	+ 6	+16	+ 10	+14
4	110	70	−10	−10	−12	+ 6	− 14	0	− 12	− 4
5	140	94	− 2	− 2	−14	−12	− 12	− 4	− 10	0
			(File complete to 56 cases)							
56	92	50	+ 2	+ 6	− 8	0	− 12	+ 4	+ 2	+ 4
Total			−40	+24	−56	+20	−194	+32	−306	−16
Average			− 0.7	+ 0.4	− 1.0	+ 0.4	− 3.5	+ 0.6	− 5.5	− 0.3

There were no consistent changes in the intraocular tension. The initial tension, as measured with the Bailliart tonometer, was for the most part within normal range, the highest reading being 44 and the lowest reading 15 mm. Hg. The average was 26 mm. for the right eye and 25 mm. for the left eye. There were often quite marked variations from the initial reading following the lumbar puncture, but, when the average for the entire group was calculated, the average change was found to be practically negligible as may be seen in table 3.

Effects upon blood pressure: No consistent changes were noted in blood pressure. The patients showed quite normal fluctuations during the examinations, but the average change was very small as may be seen in table 4.

SUMMARY

When small amounts of spinal fluid were withdrawn in the manner outlined, the following observations were made on 56 apparently physically well individuals.

1. No appreciable change following lumbar puncture was seen in visual acuity, intraocular tension, or blood pressure.

2. Pathological changes in the eye, including edema and hyperemia of the disc, were observed in 16 of the 56 cases.

3. Changes in the optic disc were associated with nausea and headache in only 9 of the 16 cases.

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RETROGRADE DEGENERATION IN THE OPTIC NERVES AND TRACTS

An experimental study of changes in the axis cylinders*

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The ocurrence of retrograde degeneration in the optic nerve following its section has long been a source of discussion (Birch-Hirschfeld,[1] Ramon y Cajal[2]). In a previous paper,[3] certain aspects of retrograde degeneration occurring in the optic nerve and retina following section of the optic tracts and optic nerve were reported. These studies showed that very active demyelinization occurred in the nerve fibers of the optic nerve posterior transection, but following section of both tracts only slight damage to the myelin of the optic nerves was observed. This would indicate two possibilities: either the optic nerves are immune to degeneration following tract lesions, or demyelinization gradually diminishes distal to the lesion and therefore is minimal or absent in the optic nerves. In support of the latter contention is the observation that degeneration after a posterior lesion of the optic tract decreased in extent as the chiasm was approached.

Experimental

In order to gain further information concerning the phenomenon of degeneration, additional experiments were made on cats and monkeys. The optic tracts were sectioned anteriorly in several animals by means of the Horsley-Clark[4] stereotaxic instrument, and optic-nerve section was performed at the chiasma by the temporal operative approach. Various periods of time were allowed to elapse prior to histologic investigation of the degenerating tissues. Since it was particularly desirable to determine the reaction in the axis cylinders, Bodian's[5] silver stain was used most extensively. In some instances Marchi or Held stains were used to confirm the presence and extent of degenerative changes in the myelin.

Electrolytic Section of the Optic Tracts

One or both optic tracts were sectioned with the stereotaxic instrument according to the technique previously reported. Four cats and six monkeys were used in the experiments. Tissue was prepared from the animals after periods of from 5 to 60 days. Silver and Marchi or Held stains were made of tissue obtained from the optic nerves and tracts.

Section of Optic Tracts Anteriorly

Successful anterior section of the optic tracts (table 1) was made in three monkeys and one cat. In cat C645 both tracts showed extensive degeneration 10 days after section, but the axis cylinders in each optic nerve were entirely normal. The lesion in this animal was made within 2 mm. of the optic chiasm, and the tracts showed great degeneration above the lesion. Marchi studies of the nerves revealed disintegration of the myelin that was much greater in the posterior portion than in the anterior (figs. 1 and 2). In the monkey M612, five days after section of the tracts, there was likewise no degeneration in the axis cylinders of

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TABLE 1

DEGENERATION RESULTING FROM ANTERIOR OPTIC TRACT LESIONS

	Time	Silver				Osmic Acid			
		Tract		Nerve		Tract		Nerve	
		Right	Left	Right	Left	Right	Left	Right	Left
M612	5	80	85	n	n	Lesion	Lesion	+	+
								++	+++
C645	10	85	85	n Anterior	n	85	80	+	+
				n Posterior	n	85	80	+++	+++
M624	12	25	20	sl.	sl.	25	15	sector+	sector+
				sl.	sl.	30	25	+	+
M629	60	n	50	++	++	n	40	sl.	sl.
				++	++	n	40	sl.	sl.

the nerves. After 12 days there was no further change, and the axis cylinder remained normal. After 60 days, M629 showed some decrease in the number of axis cylinders in the optic nerve, but the usual degenerative phenomena were absent (dissolution of the entire axis cylinder and myelin sheath structures). Held stain confirmed this reduction in the number of nerve fibers present.

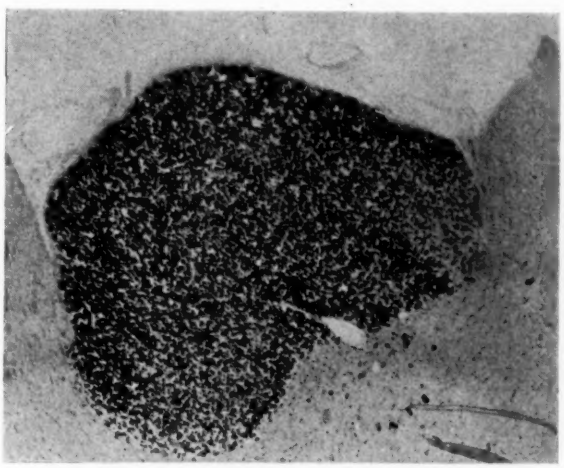

Fig. 1 (Leinfelder). Typical degeneration in optic tract following tract lesion (Marchi).

Section of Optic Tracts Posteriorly

Posterior lesions in the tracts (table 2) were accomplished in three cats and three monkeys. Sections for study were made at intervals between 20 and 32 days after operation.

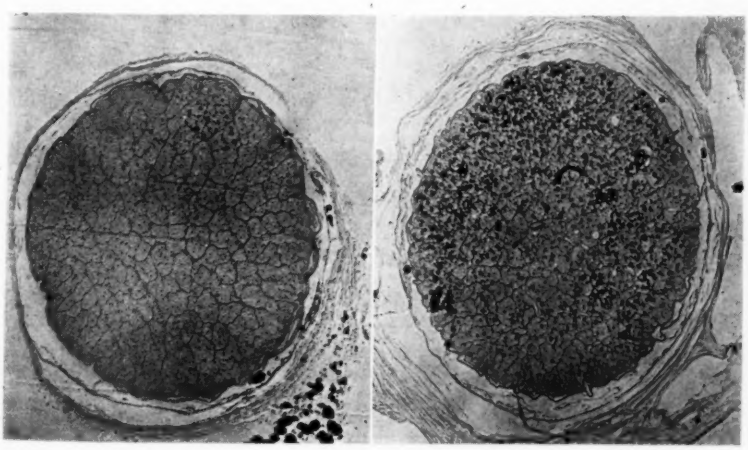

Fig. 2 (Leinfelder). Degeneration in posterior and anterior portions of optic nerve following anterior section of optic tract (Marchi).

TABLE 2

DEGENERATION RESULTING FROM POSTERIOR OPTIC TRACT LESIONS

	Time	Silver				Osmic Acid			
		Tract		Nerve		Tract		Nerve	
		Right	Left	Right	Left	Right	Left	Right	Left
C616	4					90	90	sl.	sl.
C632	20	65	80	n	n	65	80	tr.	tr.
		80	95	+	+	80	95		
M628	21	n	5	n	n	n	5	n	n
		n	10	n	n	n	15	n	n
C639	23	15	90	n	n	15	85	n	n
		30	100	n	n	15	85		
M627	24	n	50	+	sl.	n	50	tr.+	tr.
		n	90	+ thinned	sl.	n	100		
M625	32	n	40	+ sector	sl.	n	50	very slight	
		n	50	++thinning	sl.	n	60		

In cat C632, successful lesions in both tracts resulted in practically complete degeneration in the posterior tracts, somewhat less in the anterior tracts, but no demonstrable degeneration of the axis cylinders in the optic nerves. Only slight degeneration was observed in the optic nerves with osmic-acid stain, yet great changes were present in the myelin sheaths of the optic tracts.

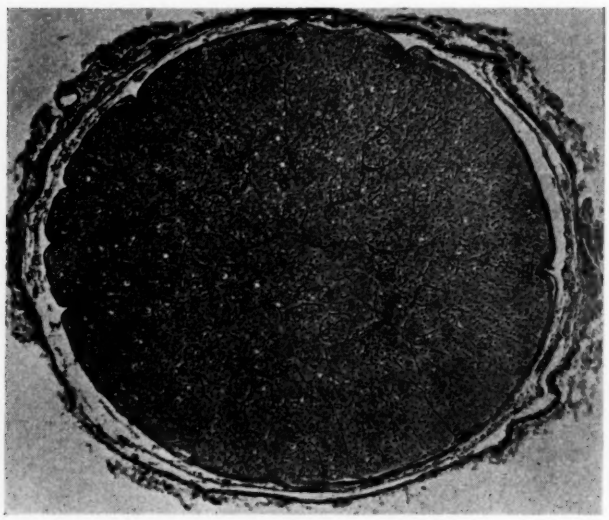

Fig. 3 (Leinfelder). Complete primary degeneration in optic nerve following its anterior section (Silver).

In the tissue from other animals, a similarity in reaction was observed. Extensive degeneration was present in the posterior tract, to a considerably less degree it occurred in the anterior tract, but only a decrease in the number of axis cylinders could be observed in the optic nerves. Although the decrease in the number of nerve fibers was generalized, the thinning was more extensive in certain areas or sectors. Evidence of degeneration was less apparent in the anterior nerves than in the posterior portion.

Osmic-acid preparations showed only slight degeneration in the optic nerves but extensive change in the optic tracts. It was likewise noted that in the osmic-acid preparations there was less evidence of reaction in the anterior portion of the nerve than in the posterior. It is definitely apparent that in all of these animals the amount of degeneration in the optic nerves, whether shown by silver, osmic acid, or the Held stain, is of little

significance when compared with the extensive changes in the optic tracts.

Section of the Optic Nerve Anteriorly

In six animals, four cats and two monkeys (table 3), the optic nerve was sectioned in the orbit, and in one cat the retina was removed from one eye. These experiments were performed in order to show the primary degenerative changes in the optic nerve and to demonstrate, if possible, efferent fibers that might be passing from the brain through the optic nerve.

TABLE 3

DEGENERATION RESULTING FROM ANTERIOR OPTIC NERVE SECTIONS

		Silver Stain			
		Tract		Nerve	
	Time	Right	Left	Right	Left
C608	5	++anterior	+	n	100
		++posterior	+	n	100
C621	10	++	+	n	100
		++	+	n	100
C626	18	++	+	n	100
		++	+	n	100
M633	20	++	+	n	100
		++	+	n	100
C634	21	++	+	n	100
		++	+	n	100
M500	87	++	+	n	100
		++	+	n	100

TABLE 4

DEGENERATION RESULTING FROM POSTERIOR OPTIC NERVE SECTIONS

		Silver Stain			
		Tract		Nerve	
	Time	Right	Left	Right	Left
M1	10	++	+	n	swollen
		++	+	n	swollen
C611	14	++	+	n	n
		++	+		
C630	14	++	+	n	n
		++	+	n	30
C613	15	+	++	30	n
		+	++		
C691	20	++	+	20	n
		++	+	40	n
C603	30	+	++	20	n
		+	++	50	n
C669	75	++	+	sl.	50
		++	+	+	80

The optic nerves of all animals showed complete degeneration of the axis cylinders (fig. 3) throughout the extent of the nerve. In the tracts the degeneration was partial because of the incomplete crossing that occurs in the chiasm. No evidence of efferent fibers could be obtained with the silver stain. Likewise as would be expected, there was no degeneration in the opposite uninjured nerve.

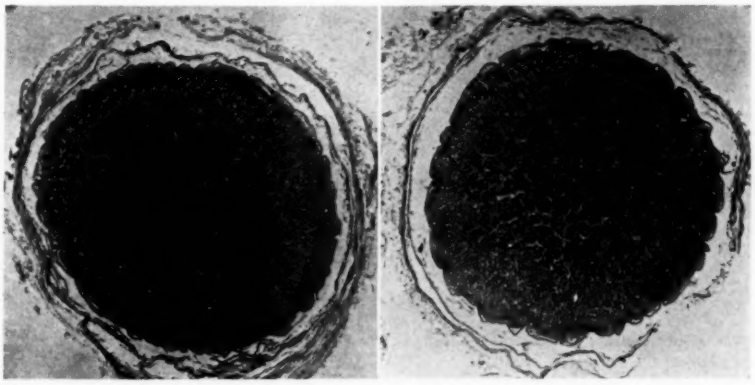

Fig. 4 (Leinfelder). Normal left and right posterior optic nerves 14 days after section of left optic nerve posteriorly (Silver).

Section of the Optic Nerve Posteriorly

In seven animals, one monkey and six cats (table 4), the optic nerve was sectioned immediately anterior to the chiasm. After periods of time (10 to 75 days), preparations were made of the optic nerves and tracts. Staining was with silver, osmic acid, and the Held method. In monkey M1 the only evidence of degeneration in the optic nerves 10 days after operation was an apparent swelling of the axis cylinders in the posterior sections of the nerve. The optic tracts showed definite evidence of disintegration of the axis cylinders. In cat C611 silver staining disclosed no evidence of change in the axis cylinders of the optic nerves, while extensive degeneration had occurred in the optic tracts (figs. 4 and 5). However, after time intervals of 30 and 75 days

Fig. 5 (Leinfelder). Typical primary degeneration in optic tract following optic-nerve section (Silver).

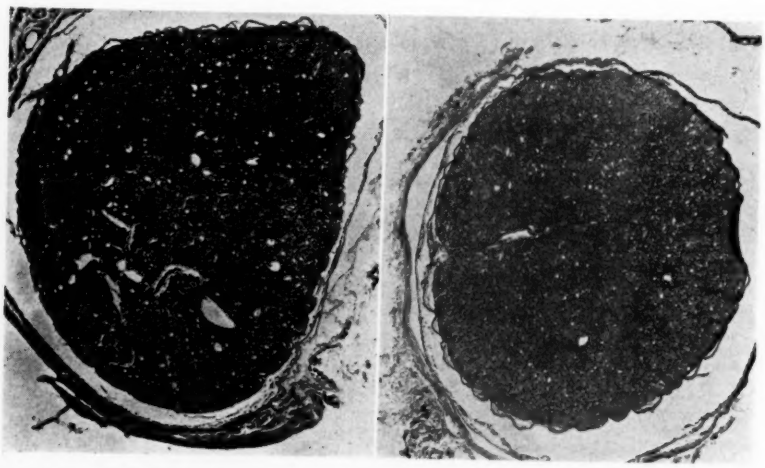

Fig. 6 (Leinfelder). Posterior and anterior of left optic nerve 75 days after its posterior section (Silver).

following operation, there was rather extensive degeneration of the axis cylinders in the posterior portion of the nerve, but less marked involvement of the anterior portion (fig. 6).

Discussion

The data from all experiments, except section of the optic nerve anteriorly, show much greater degeneration in the optic tracts than is present in the optic nerves. This at first would seem to indicate that the degree of degeneration is in some part at least dependent upon a difference in structure between the tracts and the nerves. Yet it is apparent that there is a greater degree of degeneration in the optic nerve following its posterior section than occurs in it after anterior or posterior-tract section. Likewise posterior section of the optic tract results in less intense degeneration in the chiasmic region of the tract than is present at higher levels. It is possible that the greater degree of retrograde degeneration in the nerve following posterior section is, in part at least, due to surgical interference with its vascular supply.

That the retrograde degenerative phenomena are different from the primary type is well shown in tables 3 and 4. Section of the optic nerve anteriorly is rapidly followed by complete disintegration of both myelin sheaths and axis cylinders, whereas a posterior section causes no observable early change in the axis cylinder, and later results in only incomplete degeneration. It is peculiar that posterior section of the optic nerve eventually results in a retrograde degeneration that in part bears a resemblance to primary degeneration—increased homogeneity. This phenomenon does not occur after tract lesions.

It appears, therefore, that retrograde degeneration is of an incomplete nature and that, as recognized by Boeke[6] for nerve fibers in general, it usually extends only a few segments from the lesion but occasionally a fiber may disintegrate completely. The present experiments seem to indicate that visual fibers react in the same manner. The impression is gained that the extent of retrograde degeneration in the optic nerve is a phenomenon that is dependent upon the distance of the lesion from the nerve cell, just as it is with nerves in general. Thus a lesion near the lateral geniculate body in the tract results in little retrograde degeneration in the optic-nerve fibers, while a lesion in the optic nerve results in far greater destruction of the axis cylinders.

The degeneration of some of the nerve fibers, even after distant injury, is interesting. It is known that any injury to the axon results in a chromatolytic change in the ganglion cell (Nissl[7]). The more severe the injury or the closer to the nerve cell that it occurs, the more severe will be the reaction of chromatolysis (Bielschowsky[8]). Birch-Hirschfeld pointed out that many retinal ganglion cells were only temporarily injured by the chromatolytic process, and that except for an increase in the Nissl substance, they eventually returned to normal. Many cells however completely disintegrate. The reduction in number of ganglion cells was confirmed by James[9] and in a previous paper of the author. Although a report of the study of the retinas is not included in this paper, the ganglion cells were observed in most specimens, and the reduction in number was never obvious after section of the optic tracts, but was definite after posterior section of the nerve. James observed a marked reduction in the number of cells after anterior section of the optic nerve. It appears therefore that the disappearance of the nerve fibers in retrograde degeneration occurs following, and as a result of, the death and disappearance of

the ganglion cells. The incomplete nature of the degeneration along with its late development appears to substantiate this theory.

This work, therefore, indicates that the visual pathway is not peculiar in its reaction to degeneration but that, like other nerves or afferent tracts, it reacts to injury by retrograde degeneration which is in proportion to the extent of injury and to the distance of the injury from the nerve cell.

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USE OF THE PURKINJE FIGURES AS TEST FOR SEPARATED RETINA AND OTHER INTRAOCULAR PATHOLOGY*

CLIFFORD B. WALKER, M.D.
Los Angeles

Naturally the separated retina can hardly be expected to produce entoptically the Purkinje vascular figure over the obviously detached portions. But the phenomenon which I have noted and wish to put forward as a characteristic of separated retina in general is that the apparently undetached separated retina is also unable to produce the Purkinje vascular pattern, as most conveniently tested by the recently developed small-tipped (5 mm.) penstock-handled flashlights.

This simple way of producing the Purkinje figure by oldfashioned flashlights was described by S. I. Eber and published in the American Journal of Ophthalmology (1922, volume 5, December, page 973), but has been little used. It was obtained by rubbing the tip of a small flashlight against the outer portion of the eyeball through the closed lids, upper or lower, better lower. I do not agree that the picture is produced by means of rubbing only, as a simple stimulation to the retina, as described, because the use of vibrator machines to the normal eyeball (without motion parallel to the sclera) or any sort of motion perpendicular to the eyeball that might stimulate the retina plentifully will not bring forth the picture. But the picture will suddenly flash up fully if there is enough motion at right angles to vessels and parallel to the sclera so that there is enough lateral action slightly to displace the shadow of the vessels with respect to the innermost retina; that is, with respect to the more fixed pigment layer holding percipient element tips, extending across the potential interval between the two primary layers where fluid accumulates in a separated retina. Stimulation of the retina is not necessary —only a slight motion of the vessels must be produced to cast the vessel shadow or somewhat dark-adapted retinal strip slightly off its center while differently illuminated. Then normally the complete picture flashes up instantly throughout in the manner of an all-or-none reaction. The normal shadow picture of the vessels from light transmitted through the pupil has simply been suppressed previously in the interest of safety.

The patient may see this pattern with one or even both eyes open superimposed upon his total or usual vision. If superimposed upon screen or perimeter the character of the branching, usually at various degrees of field, may be approximated. As soon as we have taught the patient to see the Purkinje figure by the method described and also the flash of the moving Neon light, we may combine the two *with the eye open* and see the Neon image (now a bluish green, due to retinal fatigue, to red) superimposed upon the reddish inverted Purkinje picture (as a screen) actually move upon the retina during the act of seeing (that is, the patient gets the impression of seeing his retina see). This makes a good test to differentiate separated retina from any other condition in which the field of vision may have scotomatous, sector, or hemianopic defects. The blinded separated retinal area and all the rest of the retina will still give the red background, but not the vascular pattern of Purkinje. Further, the elevated retina will see the green Neon image moving where large

* Condensed from the presentation before the American Academy of Ophthalmology and Otolaryngology, October 8, 1939, Chicago.

perimetric test objects could not be seen; unlike blinded areas in glaucoma, for instance. Yet the separated retina can never see the dichotonous branching or any part of the vascular picture even in the apparently undetached seeing portions and even in the first week of duration. Apparently as soon as a hole occurs in the retina, fluid saturates the space available between the two primary layers, putting nerve fibers on a stretch, sufficiently increasing the distance between vessel and percipient tips to blue the delicate shadow picture (Purkinje) beyond recognition, although much of the retina still functions quite normally until the nerve elements are actually uprooted. There may be a still earlier stage in which part of the figure is present.

Even the flattest type of separated retina fails to show any vessels of the Purkinje figure, because the slightest film of edema in the potential space between the two primary retinal layers (crossed only by percipient element tips) will increase the penumbra of vascular shadows beyond recognition. It would be easy to carry these tests too far as regards moving the eye back and forth, and so on, to see the Neon flash. Therefore, this is reversed, and the test light is moved. The patient is required to hold the eyes open and fixate on something straight ahead without winking much and the lids are held open for him if they interfere. But, to control the pressure of the flashlight Purkinje test, I have devised a little light device to be used with any spring tonometer. I prefer the Sobansky, a very accurate, durable instrument from the Hans Lauber clinic. The light (bronchoscopic) rides under the foot plates and it may be connected to the cut-off, the light, or ring a bell or buzzer at the tension reading for that individual. Very little pressure is used usually, just enough is necessary to cause the lid to slide on the sclera. The frequency of the motion is about 2 per second for a continuous picture, with such amplitude as the skin looseness permits.

In case of a separation of the choroid the Purkinje figure still persists, but I have found it absent in advanced retinitis pigmentosa. Sometimes a hematoma or hemorrhage may imitate a tumor ophthalmoscopically, and transillumination with a Lange lamp is black as in the case of a tumor. Here it is well to teach, when possible, the simultaneous observation of the Purkinje picture while transilluminating with the Lange lamp. From one case only I judge the Neon lamp will appear as a green blur over hemorrhage in the choroid. I have not yet found a tumor so early that it tests differently from a separated retina. In all other lesions of retina and optic pathway that I have tested recently, the differentiation has been sharp, showing neither figure nor Neon light in perimetric field defects.

427 West Fifth Street.

NOTES, CASES, INSTRUMENTS

A PRISM BAR OF THERMOPLASTIC MATERIAL FOR MEASURING HIGH DEGREES OF SQUINT*

CONRAD BERENS, M.D.
New York

Because of the difficulty in measuring high degrees of squint in the "corners" by means of the screen test, with narrow prisms used in the first apparatus constructed,[1] a prism bar of thermoplastic material† has been developed, using prisms 37 mm. square and ranging in strength from 1$^{\Delta}$ to 50$^{\Delta}$ prisms.

Prism bars which were constructed previously of thermoplastic material have proved to be practical for office and clinic use. One of these bars was constructed with square prisms (30 mm. by 17 mm.) ranging in strength from 1$^{\Delta}$ to 50$^{\Delta}$ prisms.[1] This prism bar has proved to be much more useful than the prism bars of glass that were originally developed.[2]

The advantages claimed for the prism bar of plastic material previously discussed have apparently been correct; namely, (1) it is less expensive than glass prism racks; (2) its lightness makes it much easier to handle, especially in performing the screen test when it is necessary to superimpose square prisms; (3) the material is colorless, difficult to break or chip, and apparently more transparent than glass; (4) if the surface becomes slightly scratched it may be easily repolished; (5) the material used produces a more pleasant sensation than does glass or metal when in contact with the skin; (6) this prism bar does not seem to show finger marks so readily as glass and is more easily cleaned than the racks in metal frames; (7) the added advantage of the new prism bar is that the wider prisms are more practical for measuring deviations in the "corners" and permit the exact superposition of loose thermoplastic prisms.

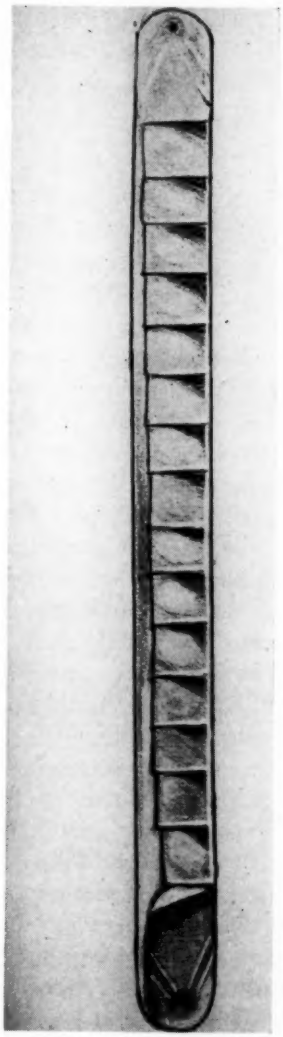

Fig. 1 (Berens). A prism bar of thermoplastic material useful especially for measuring high degrees of squint.

35 East Seventieth Street.

* Presented before the American Ophthalmological Society, 1939. Aided by a grant from the Ophthalmological Foundation, Inc.

† Made by R. O. Gulden.

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RECURRING HEMORRHAGES IN THE VITREOUS FOLLOWING GONIN OPERATION

CHARLES NELSON SPRATT, M.D.
Minneapolis, Minnesota

On September 2, 1936, Mrs. O. O., aged 39 years, was referred to me for treatment of detachment of the retina in the left eye. Two weeks previously she had noticed a blurring of the vision. There was no history of injury or strain.

The vision of the right eye was 6/12, with +1.25 D. sphere it was 6/6. Vision in the left eye was 6/60, not improved by lenses. There was a retinal detachment in the inferior temporal quadrant with an elevation of 8 to 9 diopters. A tear in the retina was located some 10 degrees above the horizontal meridian and 50 degrees to the temporal side.

After a rest of five days in bed, the detachment was flatter and the vision 6/9 minus. The patient was then prepared for operation, but due to a faulty diathermy machine, a Gonin thermo-puncture was made. An electric cautery was introduced into the sclera so as to sear the edges of the retina at the tear. After 10 days in bed the vision in the left eye with a lens was 6/9 plus.

On October 14, 1936, the patient was again seen. She stated that she had fallen and struck her head. Examination showed an extensive hemorrhage into the vitreous. The vision was 6/15. The vision improved and on December 18, 1936, equalled 6/9 plus two.

On January 27, 1937, following a severe headache three days previously, she again noticed a blurring of the vision. There was a large central scotoma, and the vision was the ability to count fingers at two feet. The vision improved so that it was 6/9 and the field was only slightly contracted.

The patient stated that on March 23, 1937, she struck her eye in going to the basement; her glasses, however, were not broken. The vision was the ability to count fingers at one foot, and there was an extensive hemorrhage in the vitreous. This condition improved and on September 14, 1937, the vision was 6/6 minus with a glass.

On October 19, 1937, the patient slipped while taking a bath but did not strike her eye or head. Examination showed a cloudy vitreous and the vision was 6/12. The eye again cleared and on May 9, 1938, the vision in the left eye was 6/6 plus.

She was seen again on October 31, 1938, when she stated that two days previously, without any injury, the vision failed. At this time the vision served for finger counting at one foot. There were floating clots in the vitreous. On December 1, 1938, the vision had decidedly improved but no record was obtained.

On January 17, 1939, when seen again, she stated that following an attack of nausea and vomiting the vision in the left eye was lost. Examination showed only light perception with extensive hemorrhage in the vitreous. Vision in the left eye was sufficient only for finger counting at two to four feet, on October 30, 1939, and a complete detachment was present.

The patient was a well-nourished woman, whose physical condition was entirely normal. Blood pressure was never

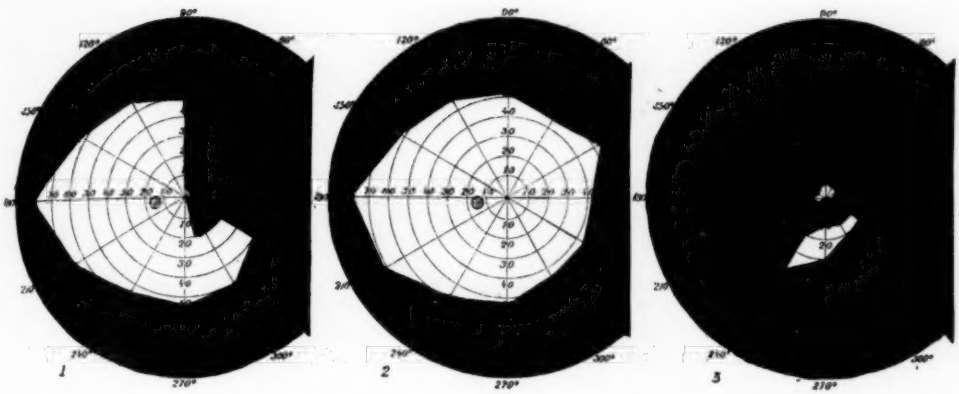


Fig. 1 (Spratt). Visual field of the left eye on September 2, 1936, before operation. Vision 6/60.
Fig. 2 (Spratt). Visual field of the left eye on May 9, 1938, after operation. Vision 6/6.
Fig. 3 (Spratt). Visual field on October 30, 1939, after six recurring hemorrhages. Vision 1/60.

over 140. At no time had the intraocular tension been over 35 mm. (McLean). These six attacks of recurring hemorrhage into the vitreous would seem to be due to the damage by the cautery to vessels in the choroid or retina.

A second question arises as to when a patient is cured of detachment of the retina. Here is a patient who for more than two years after operation had normal field and vision, yet due to later degenerative changes the vision was entirely lost. It would seem that one year is too short a time in which to judge of the permanency of a cure of retinal detachment.

1231 Medical Arts Building.

TRANSILLUMINATING AND TREPHINING THE CHALAZION: THE INSTRUMENTS FOR THIS PURPOSE*

THEODORE J. DIMITRY, M.D.
New Orleans

The chalazion is but a chronic irritation of a tarsal gland, yet no treatment of it—massaging with mercuric-oxide ointment, hot or cold applications, electric needles, and even certain surgical procedures—has obtained a cure; its cure is surgical. The mass may be incised either by skin or mucous-membrane approach, or the lid slit to curette from within the tarsus. Unless all of its fungating tissue is thoroughly eviscerated, the results are unsatisfactory. Herein is submitted a chalazion forceps which not only limits hemorrhage during the incision of the growth, but also radiates light to transilluminate the imbedded chalazion.

The generally adopted chalazion forceps are of two parts, hinged, and used to seize the lid. One division is flat and placed in contact with the skin surface of the lid; the other is a ring used to encircle the chalazion on the mucous-membrane side. When the forceps are closed on the lid the growth protrudes through the ring.

The submitted instrument differs from the general chalazion forceps in that the flat division is cut from one of the lately developed plastics and to its proximal end is attached a flashlight to transilluminate the lid. (The plastic material is a polymerized methyl methocrylate. It has a high light-transmission quality.) The light that passes into it can be controlled in its

* From the Department of Ophthalmology, Louisiana State University School of Medicine, Prof. T. J. Dimitry, Director.

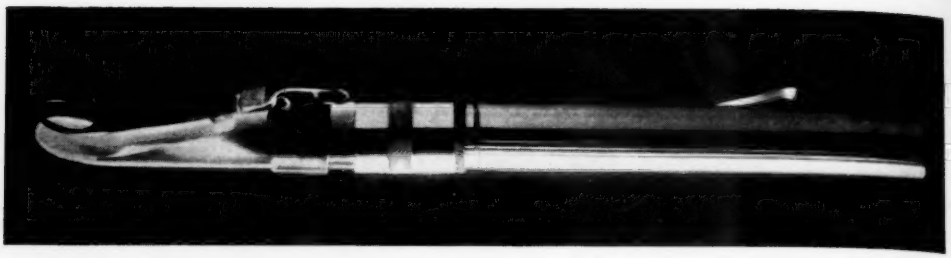


Fig. 1 (Dimitry). The Dimitry transilluminating chalazion forceps. Light is furnished by the attached Eveready flashlight. The plastic material from which the flat part is carved is screwed into the battery container and conveys the light to the disc, which, in turn, causes the light to be dispersed at right angles through the metal loop.

travel so as to become dispersed opposite the ring of the forceps. This plastic-material part of the instrument is made from a rod 1.5 cm. in diameter and approximately 8 cm. in length. An incline is cut from this bar, beginning 18 mm. from the end that is to be screwed into an Eveready flashlight, and is discontinued just short of completion. The balance, 12 to 14 mm., is left with a thickness of but 4 mm. The lower side of this flat portion is unpolished, while other surfaces are

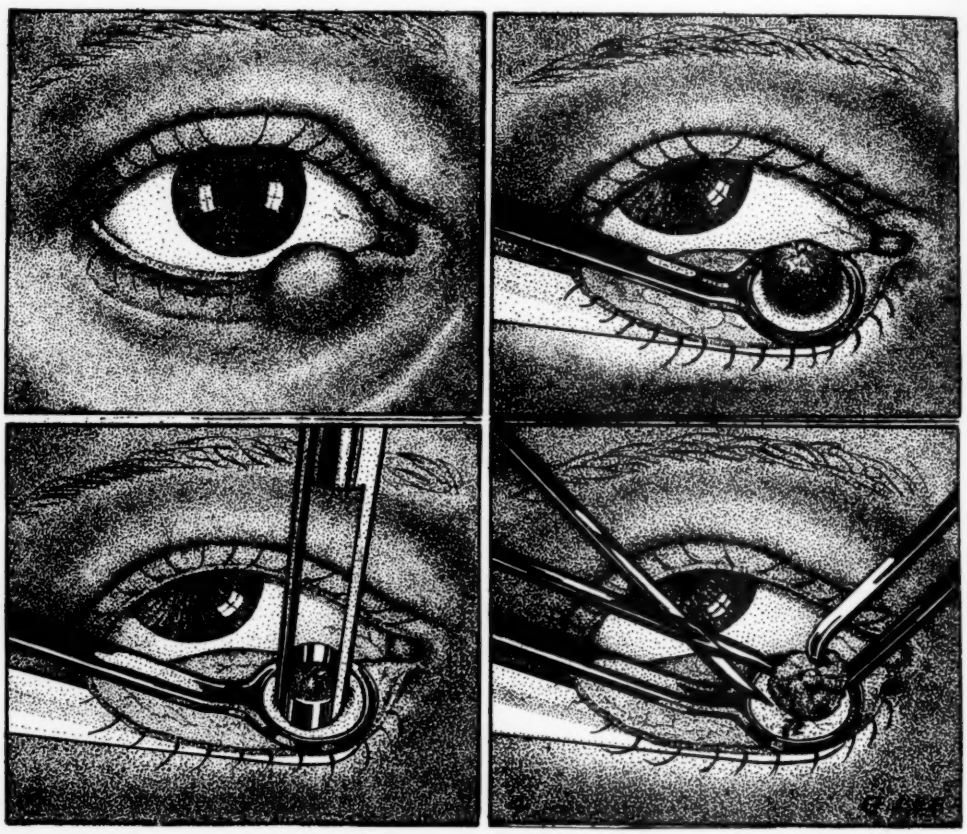


Fig. 2 (Dimitry). Trephining the chalazion: 1, the chalazion; 2, the chalazion seen by transillumination; 3, trephining; 4, cutting the chalazion attachments.

highly polished (fig. 1).

Transillumination provides invaluable assistance during trepanation of the chalazion. The mass shows dark in a field of light. A few turns of the trephine cuts and disengages the growth from the tarsus and, on withdrawing the trephine, the mass bulges ready to be clipped. The loose lid tissue then fills in the cavity created in the tarsus; the wound heals readily without leaving irritating scar tissue. There is no blood clot to be contended with. The procedure requires but a few moments and besides removing the growth completely, drainage remains free and healing is from within.

Searcy* is to be credited with having introduced trepanation as the procedure of choice for chalazion eradication. His first trephine was a sharpened trocar 4 mm. in diameter. He has not written upon the subject, but the instrument he designed has been given his name in the catalogues of instrument manufacturers.

St. Charles Street at Napoleon Avenue.

KEYHOLE DIAPHRAGM FOR THE OPHTHALMOSCOPE

ALFRED A. NISBET, M.D.
Saint Louis

The keyhole diaphragm is a modification of the usual pinhole diaphragm designed for the May-head type of ophthalmoscope. It is cut in the shape of a keyhole, to the measurements indicated in the diagram. It will be noticed that the base of the aperture is directly above the slit in the lateral surface. This placement is necessary on the illuminated-dial type of ophthalmoscope, for it is through the slit that the light reaches the dial. The neck width of the keyhole is 0.8 mm., the length of the narrow portion is 2.0 mm., and the diameter of the round hole is 2.5 mm.

In making the adjustment, several things must be considered if the best results are to be obtained. The diaphragm must be well down on the condenser. The

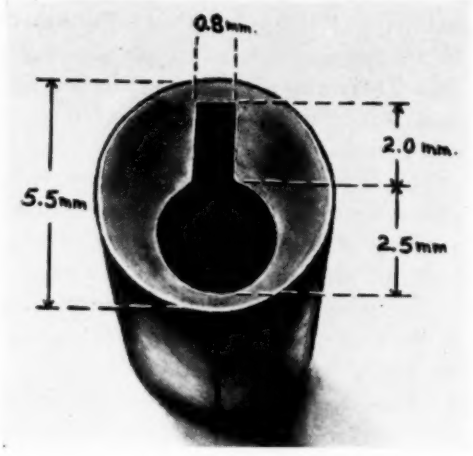


Fig. 1 (Nisbet). Keyhole diaphragm for the ophthalmoscope.

long axis of the filament must be parallel to the long axis of the diaphragm aperture. The filmament must be focused at a distance of about 30 cm. The final adjustment of the whole head must be such that the beam on a relatively distant surface has sharp margins. Some of the rays may be cut off, altering the shape of the final beam slightly, because the condensers, which vary in size, are always necessarily smaller than the diaphragm.

In as much as it may be used in all ophthalmoscopic examinations, the advantage of this type of pinhole attachment is that, in cases in which the pinhole diaphragm is not routinely used, it becomes unnecessary to remove the ophthalmoscope head in order to put on a diaphragm whenever a smaller-than-average pupil is encountered.

When endeavoring to look through a small pupil, the narrow portion of the beam is directed to the pupillary area

* Searcy, Harvey B.: A trephine for operating on the chalazion. Storz Instrument Company, Saint Louis, Missouri.

on the cornea. This band is so long that the large circular portion of the beam is shining on the lower lid, and confusing high lights are eliminated. In most instances the fovea may be seen without reducing the intensity of the light. The rays in the upper part of the band emerge at the top of the prism, thus being nearer to the line of vision through the sight-hole. There may be something in this fact that makes it easier to see through a small pupil.

The circular part of the beam may be used when examining the fundus through a widely dilated pupil, the light reflexes being of little importance in this case.

The whole beam is sufficiently large to be used for external examination of the eye.

I have used this diaphragm for a year and have found it of sufficient value to make it worthy of presentation.

Saint Louis City Hospital.

SIMPLIFYING THE DUPUYS-DUTEMPS OPERATION (DACRYOCYSTORHINOPLASTY)*

PHILIP M. CORBOY, M.D.
Valparaiso, Indiana

Several years ago, following my first introduction to the operation of Dupuys-Dutemps, I was impressed with the complete relief that the patients experienced, but the performance of the surgical procedure was a different story. In hands other than those of the originators it was difficult and time consuming, especially the dividing of the nasal mucous membrane properly and later uniting it correctly with the divided lacrimal sac. The matter of suturing has always remained quite a problem in the operation. In this paper, is offered a new method that will save the surgeon's time and offer the patient a satisfactory result.

A few years ago, Arruga modified the operation by substituting a burr for a chisel; a noteworthy advance that often saves considerable time. Now and then, however, one encounters a bony ridge that does not yield to the burr, and then the chisel is the instrument of choice.

Others have modified the technique by not sewing the incised sac and nasal mucous membrane. However, in my experience, this has been unsatisfactory.

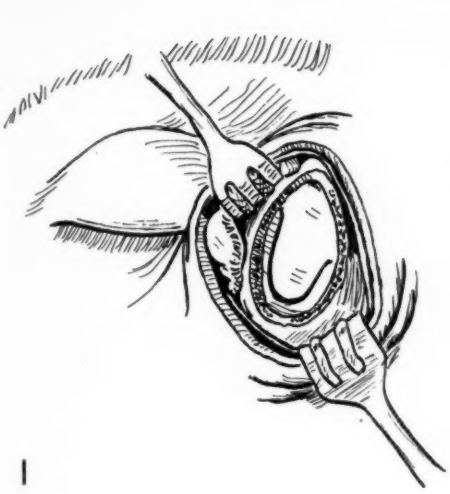
According to the original technique of Dupuys-Dutemps and his son, the sac and the mucous membrane are divided into two anterior and two posterior layers, which are then united with fine catgut sutures. This was often quite difficult especially when one has a thickened and scarred sac to work with.

The modification offered is as follows: The bone of the nasal wall is removed and its mucous membrane exposed. Then the membrane is incised, close to the cut edge of the bone, around three sides, leaving only the superior edge attached (fig. 1). This leaves a long flap of mucous membrane. The lacrimal sac after it has been isolated and freed, is treated in a like manner; that is, the sac is incised from top to bottom along its posterior edge, which in reality leaves no posterior portion of the sac to contend with (fig. 2). It can be readily seen that it is now a simple matter to make the two layers meet.

Only two #000 plain catgut sutures are used. The ends have been previously provided with a knot about 1 mm. in size, which prevents the suture from being pulled through the suture hole.

The right- and left-handed Yankar curved needles are excellent and lend themselves well to this operation (fig. 3). One suture is passed through the cut edge of the nasal mucous membrane and continued through the corresponding edge of the sectioned sac flap. The second suture is put through the nasal flap and

* From the Illinois Eye and Ear Infirmary, service of Dr. E. K. Findley.



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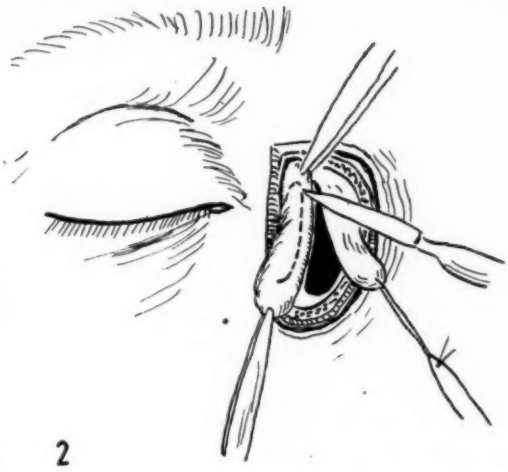

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Fig. 1 (Corboy). Bone removed down to membrane; primary incisions in nasal membrane.

Fig. 2 (Corboy). The nasal flap has been cut away from the bone and the incision into the sac is outlined.

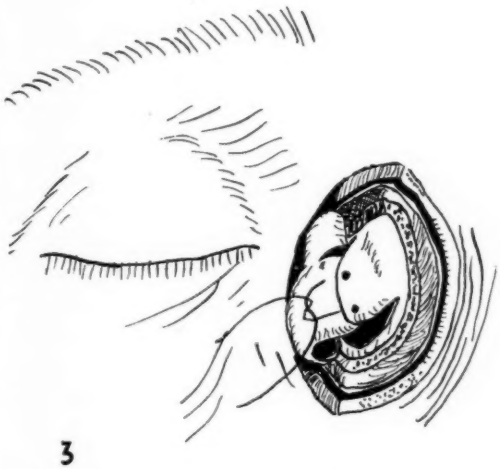

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Fig. 3 (Corboy). The two layers are being joined together by single catgut sutures, the ends of which have been provided with a knot 1 mm. in size.

then through the inferior edge of the sac and tied. The use of knots at the ends of the sutures eliminates extra sutures and the knots give the operator a good grasp on the membrane.

The procedure consists in reality in forming a roof that extends from the sac into the nose. By cutting the sac and the nasal mucous membrane in the manner described, a posterior layer is eliminated. This prevents swelling and edema that might complicate the operation. Experience has shown that a strong anterior flap is all that is necessary. With ordinary skill the operation can now be performed in 30 to 35 minutes. The operator can feel more certain of a satisfactory result in knowing that by having ample flaps he has not stretched the tissues beyond reason.

To date, 22 patients have been operated upon by this technique, over a period of approximately two years. Of the 22 cases, 18 (82 percent) have been entirely successful to date with a patent canal leading into the middle meatus of the nose. In two cases, the technique failed and no apparent cause could be ascertained as the patients would not permit further surgery. Two cases were lost from our files, and although they may have been satisfactory, it is probable that successful results were not obtained.

8 Monroe Street.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

March 21, 1939

Dr. Edwin B. Goodall, *presiding*

A case of buphthalmus—tension controlled by mecholyl and prostigmine

Dr. Samuel T. Clark presented a 32-year-old woman with buphthalmus. The patient had had 5 trephining operations, 3 iris-inclusion operations, over 70 paracenteses, and 12 Reese incisions. Her vision was 15/200 four months previous to presentation, at which time she was on a regime of weekly paracenteses. Pilocarpine, eserine, and adrenalin had all been tried unsuccessfully. Mecholyl alone was also unsuccessful, but for the past months under 20-percent mecholyl and 5-percent prostigmine used from three to six times a day, as eye drops, the eye has never reached a tension above 25 mm. Hg (new Schiötz), and the symptoms have completely abated. The case was presented to illustrate the effective control of one type of glaucoma which had had extensive surgical and nonsurgical treatment with other measures.

Experiences in European eye clinics

Dr. David G. Cogan gave an interesting talk on his visits to the foreign eye clinics. Dr. Cogan felt that America was far advanced in her clinics over any he had seen abroad.

Mechanism of recovery in ocular infection

Dr. Champ Lyons read a paper on this subject.

Virgil G. Casten,
Recorder.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

April 18, 1939

Dr. Edwin B. Goodall, *presiding*

The Keystone-Betts test as a method of detecting visual defects in school children

Dr. Albert E. Sloane read a paper on this subject.

Ocular hypotony

Dr. Daniel B. Kirby read an interesting paper on the above subject with particular reference to this condition when it occurs after fistulizing operations for glaucoma. Dr. Kirby said ocular hypotony or abnormally low intraocular pressure is a sign of serious importance in a number of conditions. It may follow trauma of the eye, whether the wounds are contusing or perforating. It does occur after cataract and glaucoma operations in which a fistulizing scar remains to permit the aqueous to filter off too rapidly.

The immediate and remote ill effects of hypotony in a few such cases were cited. They include such complications as cataract, detachment of choroid, and papilledema. The best measures for the prevention of the occurrence and continuance of severe hypotony in any case after operation were considered.

The proper treatment for early severe hypotony in which the iris remains in contact with the cornea for a week or more is not evident at this time. Elliot advises a search for an open fistula and its sealing if it is found. Cycloplegics and mydriatics may be used in the early stages.

If cataract develops or progresses because of and under these conditions the cataract may definitely be said to be due to the decompression of the eye and to the state of hypotony which ensued. Such a case was cited and the end result of restoration of vision after intracapsular cataract extraction was reported. Section through the drainage area reduced the filtration of fluid from the eye and succeeded in raising the intraocular tension.

The development of detachment of the choroid is usually not serious, as the choroid usually becomes reattached within a brief period after the operation. It can, however, be of serious moment when it is peripapillary and extends to the macular area.

The papilledema of hypotony apparently does not seriously affect the function of the optic nerve in postoperative cases of glaucoma. It should disappear when the tension has again become normal.

The condition of continued hypotony following glaucoma operations fortunately occurs very rarely but is of sufficient importance to warrant considerable thought. Surgical excision of the filtering cystic cicatrix and the bringing down of a new flap of conjunctiva and Tenon's capsule seem to be indicated—the latter to cover the trephine hole and to become more firmly adherent to an area of cornea which has been prepared by removing the epithelium and superficial layers of cornea. Such a procedure was developed by John M. Wheeler. The surgical procedure has been satisfactory for the purpose. Two cases of ocular hypotony following sclerocorneal trephining with iridectomy for glaucoma were reported. The author used the operative technique which has been described with good results.

Virgil G. Casten,
Recorder.

CHICAGO OPHTHALMOLOGICAL SOCIETY

March 20, 1939

DR. GEORGIANA THEOBALD, *president*

CASES FROM THE LOYOLA-MERCY EYE CLINIC OF LOYOLA UNIVERSITY SCHOOL OF MEDICINE

DR. CARL F. SCHAUB presented the following cases:

Case 1. *Naevus flammeus with calcified occipital hemangioma.* Robert F., a boy, aged 12 years, was seen on May 6, 1938, in the neuro-surgical clinic. The history stated that there were extensive "port wine" birth marks on the left side of the head, face, and neck and that he had had petit and grand mal attacks since infancy, mostly starting as right-sided Jacksonian seizures, some attacks limited to the right extremities.

In the previous six months the attacks had been increasing in frequency and severity, there having been some 35 to 40 attacks. There was hemihypertrophy of left face, teeth, gums and so forth, and right-side hemiparesis with definitely exaggerated right-side reflexes. Ophthalmological findings were as follows: A large left eye (buphthalmos) with vision of but 5/200 (right eye normal in size, with 20/20 vision); deep glaucomatous cup with atrophy; a definite right homonymous hemianopsia. X rays of skull revealed extensive left-occipital-lobe, markedly calcified hemangiomatous convolutions. The calcified hemangioma stopped abruptly in mid-line and extended well forward into the posterior motor area.

Case 2. *Congenital retinal cyst with retinal detachment.* M. M., a woman aged 29 years, was first seen on January 7, 1939. She gave a history of blurred vision of the left eye with loss of the upper field of vision, first noticed on December 21, 1938. There was no history of trauma or

disease and the patient did not wear glasses.

Examination revealed a normal right eye with a vision of 20/20. The vision of the left affected eye was 15/200. The external eye, pupil, and media were normal. There was a complete detachment of almost the entire lower half of the retina up to about 1 or 2 p.d. from the macula. The height of the elevation was some 14 diopters in the far inferior periphery and became less as the posterior pole was neared. The disc was normal. No hole was discerned. An ovoid, well-demarcated gray area about 2½ p.d. from the ora serrata in the 5:30-o'clock meridian was seen. This mass was first interpreted as a neoplasm, but further observation showed a good transillumination with no darkening of the reflex in the area of the "mass"; the blood vessels on its own surface seemed to waver and float as resting on a cushion of fluid when the eye was moved from side to side. Dr. Sanford Gifford concurred in the diagnosis.

Diathermy micropuncture was performed on January 18, 1939. Since no hole nor tear was discovered, a barrage of diathermic micropunctures was made in two rows from the 8:30- to the 3:30-o'clock position, the row nearer the limbus being placed 12 mm. from the limbus, the second immediately posterior to the first. In the area of the cyst, located 8 mm. from the ora serrata, an extra circle of punctures was made. Diascleral incision into the cyst was made with liberation of a watery, straw-colored fluid, presumably from within the cyst itself. The detachment itself did not settle back until a trephination was made away from the cyst with liberation of this fluid.

On March 13th, seven weeks after the operation, the retina was perfectly reattached, with normal fields for form, white, and color, and vision of 20/40+2.

On March 18th, the patient struck her head forcibly against an open door. She was dazed for 10 minutes. Seen shortly afterward, there was a slight elevation, 2 to 3 diopters in the inferior temporal retina. This will be kept under observation.

Case 3. *Bilateral (arrested?) macular cystic degeneration.* Florence J., a woman aged 39 years, was seen first on January 2, 1938. She had been fitted with glasses on February 2, 1931, and with a correction of R.E. −0.50 D. sph. ⌯ −1.50 D. cyl. ax. 180°, and L.E. −1.00 D. cyl. ax. 180°, had a vision of R.E. 20/15, and L.E. 20/15. She did not return to the clinic from 1931 until January 21, 1936.

She returned believing she needed a change of glasses. Routine refraction under homatropine cycloplegia called for correction in each eye of −1.25 D. sph. ⌯ −1.50 D. cyl. ax. 180° with resultant vision of R.E. 20/50+2 and L.E. 20/30. There was present a central, well-circumscribed circlet in the center of each macula, one-fourth p.d. in size, and deep red in color, each having a slate-gray dot in its center. They appeared as "holes." There was a relative central scotoma in each eye as studied on the campimeter slate, more noticeable in the right eye. A diagnosis of bilateral central, cystic, macular degeneration was made. General physical examination and laboratory tests were negative for pathology. There was a definite empyema of the left antrum. After unsuccessful conservative therapy a left Caldwell-Luc operation was performed.

The case was presented because there has been no apparent progress of the disease, the vision, after three years, being R.E. 20/40+2, L.E. 20/30+3, with the relative central-field changes stationary, and no apparent difference in the ophthalmoscopic picture.

Case 4. *Unusual lesion of the choroid in a child.* C. F., a boy aged 10 years, was

seen first during the course of routine refraction on November 11, 1936. The child was not aware that he had poor vision in the right eye until a visual check was made at school a few weeks previously. The left eye had 20/20 vision and cylinder skioscopy under atropine cycloplegia showed an error of only +0.75 D. sph. The error of the right eye called for a +3.50 D. sph. ⊂⊃ +0.50 D. cyl. ax. 95°. The vision was ability to detect hand movements, and light perception and projection. There was a large cecocentral scotoma. Fundus examination of the left eye revealed a lesion involving the nerve head and macula and extending approximately 4 to 5 p.d. below the disc and some 2 to 3 p.d. above; it was irregular in outline, appearing slightly slate gray, with marked tortuosity, multiplication, and distortion of the retinal vessels; the area fused and faded gradually into normal-appearing surrounding retina.

In the lesion itself there were two darker slate-gray areas, one in the macular region and one several p.d. temporally and below the disc. They seemed to be located behind the pigment epithelium, and were, at first, interpreted as two more visible parts of a larger lesion. At that time it was first thought that the lesion might be a slowly growing malignant melanoma. Watched first at weekly, then monthly, and now at six-months intervals, the lesion appears to be the same as when first seen.

Case 5. *Bilateral (subsiding?) papilledema with peripheral-field change.* J. C., a man aged 30 years, had been refracted in 1936 and was seen again on January 19, 1939. (In 1936 vision was R.E. 20/12+2, L.E. 20/12+3, with a correction of R.E. +1.00 D. cyl. ax. 170°, and L.E. +0.25 D. cyl. ax. 90° as then prescribed.)

On the occasion of his second visit he stated that several days ago he had noticed that the vision in the right eye was disturbed. There was no history of trauma, no headaches, no ocular pains, and the general health was apparently good.

Vision R.E. 20/12+2, L.E. 20/12+2 with correction. The right nerve head was definitely blurred in all its margins, but no elevation could be measured. The left nerve head showed a definite papilledema measurable as approximately 2 diopters. There was a small linear hemorrhage in the infero-temporal aspect of the swollen nerve head. The fundi were otherwise normal. Peripheral fields of vision to a 2-degree white test object showed a constricted field in the right eye, with both upper quadrants having a maximum height to 20 degrees. In the lower temporal field the restriction was to approximately 70 degrees, in the lower nasal the field was 35 degrees at the maximum. There was good central vision and no central-field change. The left peripheral field was normal with the exception of a suspicious indentation to 2-degree red test object in the upper nasal field. Stereoscopic X-ray study of the skull was negative, as was a general neurologic examination. The left sphenoid was opened because of positive X-ray findings and demonstrable pus coming from the sinus. This was done empirically as the diagnosis was not thought to be an optic neuritis.

The peripheral field picture has remained the same. The nerve head edema had subsided definitely until it was no longer measurable in the left eye, but all disc margins were still obscured. This case was presented as a diagnostic problem.

Sclerosing angiofibroma

Dr. Paul V. Carelli presented a man, aged 35 years, who was first seen in December, 1937, with the history that in September, 1934, he had noted a small swelling below the right lower lid near the external canthus. The swelling gradu-

ally became larger and unsuccessful attempts were made to remove the mass in December, 1934, and in June, 1935. In June, 1935, the patient had radium treatments about three or four times weekly for three months without effect.

When seen in December, 1937, the mass was about the size of an almond, doughy, non-pulsating; there was no bruit, no redness, and it was not painful. X-ray studies of the orbit, facial bones, and optic foramen were normal.

Examination of biopsy showed sclerosing angiofibroma. From January, 1938, to June, 1938, injections of sodium morrhuate into the mass were given once a week, beginning with .5 minim and increasing each injection by .5 minim until 5 minims were given and this dose maintained. There has been no shrinkage of the mass.

THE DISTRIBUTION OF SULFANILAMIDE IN THE EYE

DR. JOHN BELLOWS and (by invitation) DR. HERMAN CHINN said that large doses of sulfanilamide (0.2 gm. per kilogram of body weight) were given orally to dogs, and blood and the various tissues of the eye were analyzed at intervals from 15 minutes to 48 hours. Sulfanilamide could be detected in all tissues examined within 15 minutes after its administration, and a maximum concentration was reached about the sixth hour. The concentrations in decreasing order were found as follows: In the blood, chorioretinal layer, corneo-scleral layer, aqueous humor, lens, and vitreous humor. Little difference could be detected in the tissues when therapeutic doses were administered twice daily or four times daily. Heat, atropine, and eserine, applied locally, had no effect on the sulfanilamide concentration of the aqueous humor. Mecholyl, similarly applied, increased the penetration into the aqueous. The second aqueous contained somewhat more sulfanilamide than did the original aqueous. Sulfanilamide has been analyzed in tears.

Discussion. Dr. Harry Gradle believed that while Dr. Bellows's work was valuable, the experimental evidence did not quite agree with the clinical evidence in one respect. It had been found clinically that sulfanilamide in trachoma was infinitely more effective in divided doses spaced fairly evenly over 24 hours. Massive doses were necessary; small doses were of no particular value. A dosage of one-third grain per pound of body weight every 24 hours gave the best results. In a series of 722 cases of trachoma the results had been satisfactory in about 75 percent. The damage that had occurred in trachoma could not be eliminated, but the disease could be arrested at the point at which the drug was administered. It had been found most efficacious in trachoma II and III, fairly effective in trachoma I, and of little value in trachoma IV. Whatever damage had been done—such as scar tissue, connective tissue, distortion of the lids, or vascularization of the cornea—was not affected, but the disease was arrested.

Dr. John Bellows (closing), in reply to Dr. Fowler, said that one eye was used as a control, the first aqueous being removed from it at the same time that the second aqueous was aspirated from the other eye. In answer to Dr. Smith's question, the most probable examination for the cyanosis that might result is that advanced by Hartman and his co-workers (Jour. Clin. Inves., 1938, v. 17, p. 699), who found that in a majority of patients receiving 0.1 gram or more of sulfanilamide per kilogram body weight every 24 hours, cyanosis developed. In every case of cyanosis, methemoglobin was observed. Considerable quantities of methemoglobin, of course, would decrease the oxygen-carrying capacity of the blood. With reference to Dr. von der Heydt's

question, the authority for its use in dendritic ulcer was Kleefeld, an abstract of whose article appeared in the Zentralbl. f. d. ges. Ophth., 1938, v. 42, Dec., p. 170. There were no increased cells in the aqueous. The mechanism of sulfanilamide action is not by means of increase in leukocytosis; it seemed to act chiefly as a bacteriostatic agent.

Concerning dictyoma retinae

Dr. Bertha Klien presented a paper on this subject.

A comparison of visual acuities

Dr. Samuel Blankstein (Milwaukee, Wisconsin; by invitation) in collaboration with Dr. Jane Fowler read a paper on this subject which was published in this Journal (December, 1939).

Discussion. Dr. Samuel Blankstein (closing), in reply to Dr. Smith, said that this study was made at a university graded school, where the I.Q. of the pupils was supposed to be good, but some of them were low. Dr. Gradle's question was important. Many offices use Snellen cards with reflected light. The illumination is estimated by the indirect method, making it difficult to obtain an accurate evaluation. It was felt that the study would be more satisfactory if the same illumination were used for all persons, the amount being within an accepted standard range. All adults were examined with the same illumination, as well as all children. The problem of individual variation in taking tests was solved by having one observer do the Snellen estimations and another all the Betts tests, with as little difference in the technique as possible.

With reference to Dr. Allen's query, the experience at Dr. Brown's clinic at Billings Hospital was interesting. Where such estimations were made carefully, the visual-acuity tests corresponded very closely between individuals. He had taken the vision himself with the Snellen charts and was satisfied that they were accurate. There may be individual differences. Obviously, there are a number of problems relative to visual acuity about which little is known.

Robert von der Heydt.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

April 24, 1939

Dr. Fowler Hollabaugh, *chairman*

Retrobulbar abscess due to pneumococcus conjunctivitis

Dr. Eugene Orr presented the case of Mr. E. E. C., aged 24 years, who was first examined on June 16, 1938. The history was that the left eye had been inflamed for one week. The inflammation was chiefly confined to the bulbar conjunctiva and had every appearance of pneumococcic conjunctivitis; culture was taken and 1-percent optochin used. At the next visit there was marked chemosis, slight though definite proptosis, and limited motion of the globe. The laboratory reported the culture positive for pneumococcus (not typed). Examination of nose and ears proved negative, as also the X-ray study of the sinuses. There was no history of injury, nasal trouble, nor were there any of the conditions ordinarily regarded as causative factors in retrobulbar cellulitis or abscess. The pupil was dilated and did not react to light.

On June 20th there was marked proptosis; the eye was fixed; there was slight blurring of the nerve; the vision was 20/200; however, with —3.00 D. sph. it was near 20/30. There was a pouting point of the conjunctiva along the lower border of the internal rectus, about midway of the muscle. This was opened

through Tenon's capsule, and curved scissors were passed deep into the retrobulbar region. A moderate amount of pus was evacuated. Culture of the pus showed pneumococcus. The abscess was reopened a time or two and recovery was uneventful.

On July 1st the eye was quiet and essentially normal in appearance. Vision with a —1.00 D. sph. was 20/20. The patient was seen a few weeks later and showed no further change.

Andrew Hollabaugh,
Secretary-Treasurer.

SAINT LOUIS OPHTHALMIC SOCIETY

April 28, 1939

DR. B. Y. ALVIS, *president*

INTRAOCULAR FOREIGN BODIES

DR. R. E. MASON read a paper on this subject.

Discussion. Dr. F. E. Woodruff said that he had had the opportunity of reading Dr. Mason's paper and found there was much room for thought and much to reflect upon. There were a few points he would like to emphasize. The first point is in regard to the statement of the patient as to the presence or absence of a foreign body. We must take the evidence of the X ray and if the X-ray report is negative we are only then satisfied that there is no opaque foreign body. For other foreign bodies that will not show up with the X ray we have to use our best judgment regardless of the patient's statement. If we find one foreign body in the eye we should not be too sure that it is the only piece of metal there.

The operation of choice depends upon the location of the foreign body, not at the time when first seen, but at the time of the operation. As an illustration he had a patient who had had birdshot in the eye for about nine years. The shot could be localized at first but the eye was quiet and it was thought wise to wait. Years later when there were signs of irritation another X-ray picture was taken, and the shot had shifted position considerably to the floor of the eye in the neighborhood of the ciliary body. The last picture was the one followed and the shot was removed.

Dr. Mason overlooked mentioning the use of the slitlamp in locating foreign bodies. We may find in the anterior chamber some slivers of glass which can be seen better with the slitlamp than by any other means. We saw a case that had been under competent treatment for 18 months and a fragment of glass which had been overlooked was found in the anterior chamber and removed.

In making scleral incisions for foreign bodies, he believed there was more danger in making too small an incision rather than too large a one. This applies also to cataract operations. If there is copper or brass in the eyeball, we either get the copper or brass or the eye. With lead we can wait. We have seen instances in which there has been a foreign body in the lens that has become incapsulated, the lens becoming cataractous in a very limited area only.

He complimented Dr. Mason on his timely and excellent paper and also on the success which he has had in the removal of foreign bodies from the globe.

Dr. William F. Hardy said Dr. Mason's paper brought out many points of interest only a few of which he wished to discuss. It had been his fortunate or unfortunate experience to have had a number of intraocular foreign bodies in one-eyed people, the handling of which cases called for extreme care.

The first point in the paper to be discussed is the route of attack. For many years he was an advocate of the scleral

route, but in the last 10 years he has preferred the anterior route conditional on certain circumstances. If the case is recent and the point of entry is through the sclera, the original wound is utilized. It would be unwise to drag a large foreign body into the anterior chamber, especially if the lens was uninjured, because of possibly injury to the lens and entanglement in the iris. Thus the choice of route depends to some extent on the size of the foreign body.

The second choice has to do with the choice of magnet, whether a giant or small one. He believes that it is wrong to use a giant magnet on a large foreign body because of the sudden terrific pull which causes the foreign body to come with a rush, damaging structures on its way. He has seen the iris completely torn out of the eye. The size (pull) of the magnet should be inversely proportional to the size of the foreign body which, if possible, may be teased into the anterior chamber and then extracted.

With a foreign body in the lens he would prefer to let the lens become opaque and then remove both lens and foreign body at one sitting. One learns a number of helpful manipulations in dealing with intraocular foreign bodies. If the length of the particle of steel or iron is much greater than its breadth it may sit astride the original or operative wound. Rotating the hand magnet 90 degrees, with the power on, will facilitate the removal of the foreign body. This is particularly true when using the scleral route inasmuch as the object cannot be seen. The chief objection to making a scleral incision if the sclera has been uninjured is the possibility, not remote, of a subsequent detachment of the retina.

Dr. A. D. Calhoun asked Dr. Mason about the percentage of late detachments he has seen and also how late an industrial case may be reopened where there has been a definite detachment. Six months ago he had seen a young man who had had a perforating scleral wound in the lower temporal quadrant from a piece of glass. Four years later a retinal detachment occurred. The retina showed a definite tear in the exact quadrant of the original foreign body. This penetration brought up a very definite point as to whether the patient was entitled to compensation for the loss of an eye or not.

Dr. W. M. James stated that in December, 1938, he saw a young woman who had been thrown through an automobile windshield five days previously. The cornea of the right eye was lacerated from the 12- to 6-o'clock position. A thin scale of glass was removed from the deep corneal stroma. After healing had taken place a microscopic spicule of glass was discovered in the iris near the pupillary border at the 6-o'clock position. The eye is quiet and the vision is 20/200. Should the piece of glass be removed?

Dr. Meyer Wiener said first in regard to the use of the magnet by the anterior route that he had studied with Hirschberg Haab and had seen them remove foreign bodies in this way. There was not a magnet in Saint Louis at that early time and he constructed a giant magnet at the old Manual Training School. In those days he was doing considerable industrial work and had many foreign-body cases. He abandoned the anterior route because he found it more dangerous to the eye. He was able to get the foreign body out by the posterior and direct route much better and much more easily than by the anterior route. He was glad to hear Dr. Woodruff say that he felt that the incision should be large in the sclera. He believes one of the reasons we do damage is because we try to get the foreign body out with too small an incision. He places the point of the magnet into the opening of the sclera and turns on the current.

He had had very little experience with detachment of the retina following such operations, and now thinks this form of detachment of the retina is more amenable to treatment than any other.

As far as X rays are concerned, we should be careful of the reports from X-ray laboratories. We had a case of a young man who thought he had a foreign body in the eye. While talking to a blacksmith, he felt a sting in his eye. His vision blurred occasionally. His vision was 20/20 in the eye, but on account of the history we had the eye X rayed. When the X ray was made the foreign body was reported localized just outside the sclera. We observed the eye closely and were fortunate to locate, with the ophthalmoscope, the foreign body in the sclera before the X-ray report was received. We removed the foreign body, the patient retaining normal vision. When anyone comes with a suspicion of having glass in the eye, we ask him to secure a piece of the glass he was using. We then place a large piece and a small piece on the plate when taking the X ray and if the glass has lead in it, it will throw a shadow on the plate. Then we can tell whether to expect a shadow or not when X raying the eye for a glass foreign body.

Dr. John Green reported that it has been his experience that with double perforations from birdshot, if the point of entrance is in the sclera, enucleation may not be necessary. It is important to determine whether the implements in use at the time of the injury are magnetizable. Have the patient bring them to you for this purpose. As Dr. Woodruff has stated, every patient with extraocular or intraocular foreign body should be subjected to a searching examination with the corneal microscope. Every case should have an X-ray examination.

A boy of 12 years had been out in the woods with a rifle and returned home with an injured eye. He stated that a twig had brushed his eye. He saw the patient four weeks after the injury. The cornea was perforated, the iris injured, and the lens cataractous. Relying upon the history he did not have an X ray made. At the operation the injured iris was excised and the soft lens matter washed out. A glistening white particle lying in the coloboma was noticed by Dr. Workman, who was assisting. This was grasped by forceps and extracted. It proved to be a particle of lead. X ray then showed another fragment deep in the eye. A vitreous abscess developed and the eye had to be removed. The patient then admitted that he had loaned his rifle to a young companion who had fired at a large glass container; the bullet shattered and two fragments had been deflected into the eye.

Dr. R. E. Mason in closing said with regard to localization of foreign bodies in the vitreous, he wanted to mention a particular case he now had and how X rays can mislead one.

The X ray showed the foreign body behind the eyeball. After showing Dr. Ellis what he thought was a foreign body, he took the patient to the operating room and while one applied the magnet, he examined the eye with the ophthalmoscope; the foreign body was seen to jump around. If the foreign body is behind the globe, the foreign body will not change its position on the different movements of the eyeball.

As to the efficacy of a large or small incision, he agreed with Dr. Woodruff.

In regard to percentage of late detachment, in his experience detachments have either come on right away or not for a long time. When we get an intraocular foreign body in the vitreous chamber, we recommend that the patient keep his case open for a year or year and a half. In Missouri the case can be reopened on a change of condition. A patient does not

waive his rights by accepting the check. In the state of Missouri a case can be opened for at least a year or two. He has had no experience with the removal of nonmagnetic foreign bodies by the biplane fluoroscopic examination. Dr. Hardy brought up the question of changing his method of operating from the posterior to the anterior route. He had so many detachments result from cases he thought were easy he wondered if the detachments were because of the scleral incision or not. If a cataract develops, he always tries to remove the foreign body through the anterior route. He believes we are inclined to use too large a magnet and to extract foreign bodies too quickly. He has read of men who take two or three days to take a foreign body out of an eye. With regard to Dr. James's case of glass in the anterior chamber, he believes it should be let alone unless it is causing damage.

Adolph C. Lange,
Editor.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

May 22, 1939

Dr. Henry B. Le Mere, *presiding*

Homer Smith method of extraction of immature lens in dinitrophenol cataract

Dr. Sydney Brownsberger discussed the surgical treatment of immature cataract and said this applies particularly to that small group of persons between 30 and 50 years of age who see so poorly that their usefulness is greatly lessened. Many times the cataract will not become mature for several months or years. It is therefore necessary to operate on the immature cataract.

The procedure in his two cases of immature dinitrophenol cataract was as follows: The patient was admitted to the hospital and the pupil dilated with homatropine. Capsulotomy was performed by making a cruciate incision extending deeply into the soft lens with a small Ziegler needle-knife. Careful observation was important during the next 24 hours to anticipate possible increase in intraocular pressure. Extraction was made between 6 and 24 hours after needling, depending upon the rapidity of hydration of the lens. If tension was raised, a retrobulbar injection of novocaine with three minims of 1:1000 epinephrine was given 40 minutes before operation. O'Brien facial block and bridle suture on the superior rectus muscle were used. The type of incision depended on the size and consistency of the lens nucleus. The slitlamp often gave some information, but the preliminary capsulotomy indicated definitely whether there was a soft nucleus that could be expressed through a linear keratome incision, or a hard nucleus requiring a limbal incision of given size.

By use of the Madras irrigator, lens fragments could usually be removed through a round pupil. The main advantage of this irrigator was that it was possible to direct a stream of saline into the anterior chamber without inserting the tip of the instrument between the lips of the wound, thus avoiding unnecessary traumatism to the intraocular structures.

Case 1. Mrs. A. H., aged 30 years, came to Dr. Brownsberger in December, 1937, with a history of having taken three capsules of dinitrophenol daily for two months. These capsules were taken in 1936 and no visual symptoms were noted for approximately one year. Vision was 20/40 in each eye. Slitlamp examination revealed the typical findings of dinitrophenol cataract.

In November, 1938, vision had dropped to 20/100, and preliminary capsulotomy was performed on the right eye, followed

by linear extraction with round pupil. The interval between capsulotomy and extraction in this case was approximately eight hours. Corrected vision was 20/20. The left eye had not yet been operated on.

Case 2. Mrs. E. M. was seen in February, 1936, with a complaint of dimness of vision in both eyes, following ingestion of 300 milligrams of dinitrophenol daily for approximately one month. Ocular symptoms were noted three months later. Slitlamp findings were typical of dinitrophenol cataract. In September the left mature cataract was removed by the extracapsular method, resulting in 20/20 vision with glasses.

The immature cataract in the right eye did not become mature within a period of three years. The vision remained at 20/80. Slitlamp examination showed slight translucency of the anterior cortex, a perfectly clear nucleus, and typical granular posterior subcapsular opacities. The right eye was operated on by the preliminary capsulotomy technique with round pupil and linear incision in April, 1939. The interval between capsulotomy and extraction was 24 hours. Recovery was uneventful, and refraction had not yet been done.

Discussion. Dr. A. R. Irvine stated that in his private practice he had been successful in removing several dinitrophenol cataracts by the intracapsular method. For many years he has used the Homer Smith method in selected cases of immature senile cataract. It is his opinion that this would be a safe and conservative method of dealing with immature dinitrophenol cataract.

Dr. Harold F. Whalman stated that the cataracts seen coincident to the taking of dinitrophenol had changed markedly with respect to their maturation. One hundred and forty cases which he studied between September, 1935, and December, 1937, all showed a rapid rate of development and averaged about six weeks from the time of onset to the time of maturity. During the past year all cases seen by him were of extremely slow maturation and in several cases showed a slow gradual increase in opacity over a period of more than 18 months.

This necessitated a different method of surgical treatment from that previously used in cases of dinitrophenol cataract. Whereas in the earlier cases the lenses were swollen, the embryonic suture lines split open, and water clefts prominent, linear extraction was the simplest and safest procedure. Now one had to choose between intracapsular extraction, extracapsular delivery, or the Homer Smith method.

Dr. Whalman stated that while intracapsular removal is possible it may be risky, for the patients are usually young, the zonule is tough, and there is often a positive posterior-segment pressure that may result in loss of vitreous. The extracapsular method is difficult on account of the immaturity of the lens. Therefore the Homer Smith method lends itself to selected cases. He emphasized the advisability of thoroughly washing out all of the lens substance as soon as possible, for it seems that lenticular remains are particularly irritating in dinitrophenol cataract.

Harold F. Whalman,
Editor.

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MEETING OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY

On June 2, 1940, the day preceding the opening meeting of the American Ophthalmological Society at Hot Springs, Virginia, 175 friends and former pupils of Dr. Frederick Verhoeff of Boston gathered to honor him at a dinner held in the beautiful Empire Room of the Homestead. Dr. E. V. L. Brown of Chicago acted as toastmaster and introduced the following brief speakers: Dr. Jonas Friedenwald of Baltimore, who spoke on "Verhoeff the pathologist"; Dr. Edwin M. Neher of Salt Lake City, on "Verhoeff the teacher"; Dr. Hans Barkan of San Francisco, on "Verhoeff the ophthalmologist"; Dr. Phinizy Calhoun of Atlanta, on "Verhoeff the man"; and Dr. Allen Greenwood of Boston, who spoke on "Verhoeff the colleague."

The Brooklyn Ophthalmological Society presented Dr. Verhoeff with an original cartoon showing him bending over a microscope and smoking furiously. Each guest was given a copy as a souvenir. The ophthalmic staff of the Massachusetts Eye and Ear Infirmary presented him with a silver bowl suitably engraved. Dr. Verhoeff's response was in his usual witty fashion, although tempered by the affectionate and moving addresses in his honor.

The seventy-sixth annual meeting of

the American Ophthalmological Society was held the next day, on June 3d. One hundred members and 14 guests registered. The program was well balanced between clinical papers and those of more strictly scientific interest. Twenty-six papers, all instructive, were read, and most of them created valuable and lively discussion.

The following officers were elected to serve for 1940-41: Dr. Phinizy Calhoun of Atlanta, president; Dr. Allen Greenwood of Boston, vice-president; Dr. Eugene Blake of New Haven, secretary and treasurer. It was voted to hold the 1941 meeting at Hot Springs, Virginia, early in June. The meeting adjourned on June 5th.

Derrick Vail.

UNDULANT FEVER AND THE EYE

The disease now called undulant fever has been known for more than 100 years. It first attracted attention at Malta in the Mediterranean, where English soldiers and sailors contracted it. Sir David Bruce discovered the cause to be a microörganism that infested goats and caused abortion. The name, Brucella abortus, was given to it. Earlier names for the disease were Malta fever and goat fever. Later, a Danish veterinarian, Bang, found a Brucella had caused abortion in cattle, and the disease has sometimes been called Bang's disease. It is now known that Brucellosis is widely distributed in many countries. From cattle it may be acquired through raw milk that has not been pasteurized. Recently, attention has been drawn to lesions that occur in the eyes, and important because they give the first positive evidence of the cause of disturbances occurring in the general nervous system.

At the meeting of the American Ophthalmological Society that was held in San Francisco in 1938, Dr. John Green of Saint Louis read a paper on undulant fever, including the histories of four cases that he had observed, which should command the attention of American ophthalmologists. Undulant fever may cause pain and disability and other general symptoms for years before the real cause is suspected. The patient knows he is sick, but his condition may be ascribed to tuberculosis, focal infection, sequellae of some acute disease, or eyestrain. Some days there may be high fever, on others none. A cutaneous rash, or other symptoms may be ascribed to sinus conditions and bad teeth. In some parts of the country malaria is blamed for the trouble. Treatment for any or all of these has proved ineffective.

It is only when specific tests are applied that the real nature of the case becomes evident. The chief laboratory tests for its diagnosis are: the presence of the organism in the leucocytes of the patient, a blood agglutination test, or a skin test by applying preparations of killed bacilli to the skin of the patient's forearm. In the cases reported by Green the diagnosis was made by laboratory test. One patient had conjunctival and corneal lesions, such as are familiar in phlyctenular disease; one had congestion and hemorrhages of the retina; one had acute optic neuritis, reducing vision to 8/30; and one had retinochoroiditis, reducing vision to 20/70, which after a few months was restored to 20/25. Green cited from the papers of 24 writers cases of retinal congestion and hemorrhage, optic neuritis, retinochoroiditis, blindness with partial recovery, hypopyon, panophthalmitis with atrophy of the globe, blindness from atrophy of the optic nerves, papillitis, papilledema, paralyses of external ocular muscles, especially the abducens, iritis with extensive posterior synechiae, re-

strictions of the visual fields, and dilated and fixed pupils. One case of complete coma, with loss of pupil reactions, ended in recovery.

In the last volume of the Cumulative Index Medicus, there are titles of 90 papers referring to undulant fever and its diagnosis. The majority of these appear in European journals, but several of them come from widely scattered parts of the United States. They give force to the question by Green: "Should not the ophthalmologist include in his list of possible etiologic factors a disease that is widespread, and has been proved capable of affecting almost every tissue of the body?"

Edward Jackson.

"HYGEIA" AND CORNEAL TRANSPLANTATION

In Hygeia, "The Health Magazine", the editorial staff of the American Medical Association has made a worthy effort to correct popular prejudices and misapprehensions, and to impart to the general public a sound understanding of medical and health problems. On the whole, the service has been worthily performed, and in the pages of Hygeia a number of prominent physicians have manifested their ability to expound technical detail in every-day language.

The value of such a magazine is real in spite of the fact that its paid circulation is chiefly among physicians. Its presence on the reading table of the doctor's waiting room brings it to the attention of a great number of patients, whose interest is caught and held by its abundance of well chosen illustrations and attractive headlines.

It is natural that lay story-writers employed occasionally by Hygeia should not adequately appreciate the need for conservatism and accuracy, or realize to what extent erroneous statements may arouse false hopes or lead to fruitless expenditure of meager financial resources by patients and their friends. But it might be hoped that the critical faculty and conscience of Hygeia's editorial staff would detect and remedy misstatements and exaggerations. Yet we have been told that even Jove nods, and editors, like all other humans, are fallible. It may be further remarked that the delicate and complicated structure of the visual organ constitutes an ever-ready pitfall for the lay reporter, and even perhaps for the medical editor.

In the issue of Hygeia for April, 1940, a writer named Grace Igo Hall, under the title "After the War is Over," has undertaken a description of the well-known Fitzsimons General Hospital of the United States Army Medical Department, situated in the vicinity of the city of Denver. The article deals in popular style with such topics as treatment of various forms of tuberculosis, occupational therapy, laboratory diagnosis, recreations, and diet kitchens.

As might be anticipated, our author finds the travelling fairly smooth until she ventures into ophthalmology. After a preliminary excursion concerning a "veteran whose high blood pressure had caused the blood vessels to burst so rapidly in his eyes that he lost sight in both of them" but whose eyes were "restored to normal vision" after six months rest and treatment, she gives a garbled account of a case of corneal transplantation. The present commentator's information is that this individual operation, like so many others in this fascinating but baffling field, appeared to promise well for a short time but was ultimately quite unsuccessful as to restoration of vision, the graft undergoing the familiar secondary vascularization and opacification.

"One of the crowning triumphs in eye

surgery" says Miss Hall, "was performed by two army doctors in February, 1938, in the eye department of Fitzsimons General Hospital, when a veteran who was blind in one eye was given a new eye to replace the sightless one. This delicate operation, fascinating to physicians and surgeons throughout the Rocky Mountain region, was similar to corneal transplants that have been performed in Russia and France for several years and a few times in the United States."

The writer goes on to make a statement which must be regarded as journalistic fiction. "A few months after the operation had proved successful," she tells us, "I talked to the patient who leaned comfortably back in his chair as he looked at me from two equally good eyes. 'Sure, I've got two good eyes instead of one, thanks to the doctors here, and to a farmer who lives near Denver. He gave me his eye which wasn't worth a dime to him, or so he said.' "

The operation which formed the basis of this picturesque account was given a great deal of the usual glorified newspaper publicity immediately after the attempt was made. One wonders whether Miss Hall obtained more or less of her information in the case by reading the newspaper columns, which of course gave an altogether premature picture of the success anticipated. She can hardly have acquainted herself with the actual character of the operation of corneal transplantation, the extent to which it had been performed in the United States, or the frequency with which it might be expected to succeed or fail.

In cold fact, the failure of the attempt was evident a month or so after performance of the transplantation. The report of the case by the Hygeia writer is an example of colorful but not too scrupulous journalism. Acceptance of such an article without complete assurance as to the bona fides of the writer is unfortunately capable of discounting the value of Hygeia in the eyes of the medical profession and of the general public.

Exaggerated and misleading reports of medical and surgical cures are contrary to the ethics of the medical profession. They arouse false hopes in patients and their families and frequently lead to useless expenditure of financial resources. Their publication should be resisted by the profession and its organized representatives, including the editors of medical publications.

W. H. Crisp.

THE A.M.A. AND RESEARCH SOCIETY MEETINGS

The ninety-first meeting of the American Medical Association was held in New York City during the week of June 9th. The program of the Association for Research in Ophthalmology was presented on the Tuesday preceding the Section meeting, as has been customary since the inception of the Research society.

The attendance at the Associaion meeting was somewhat disappointing in view of the excellent program. This was especially marked in contrast with the good attendance at the Section meeting. The old guard was there but too few of the younger men appeared, to whom this effort should particularly appeal and whom it was primarily hoped to interest.

The idea of the "commission" to censor and present questions has not worked out as well as might have been hoped. It was a clever way to start the association but is it not, perhaps, time to abandon it? No question is ever rejected by a commissioner, so why not let the interrogator make his own inquiry? For some reason very few questions are asked, many papers being followed by none. Might not discussions be better than questions?

Somewhat more time might be required but usually the program has not been too long, and more interest might be aroused by discussion. Does not the commission give the impression of a defensive body rather than one to encourage quizzing?

At the luncheon given by the Association, a very pleasant affair, the Dana medal was presented to Mr. John M. Glenn, who had always been active on the legal end in aiding prevention of blindness and especially in the struggle to obtain passage of suitable laws in the early days of this movement.

The Section opened on Wednesday in the Roosevelt Hotel, conveniently situated near the Grand Central Station.

After the chairman's address on the critical point in glaucoma, Dr. Ellett, the guest of honor of the Section, demonstrated interesting cases of unilateral exophthalmos.

To discuss in detail the many excellent papers of the first two days is not possible here, but comment must be made on Friday's splendid joint session with the Section on Nervous and Mental Diseases.

As was to be expected, the neurosurgeon advocated the supraorbital approach to orbital tumors because many of these extend into the cranium; while the ophthalmologists contended that preoperative differential diagnosis was often possible, hence in many cases the simpler orbital route was preferable. The different points of view may easily be accounted for by the fact that the neurosurgeon does not see so many of the simpler anterior orbital tumors as does the ophthalmologist, but mostly those referred primarily because of central symptoms.

Two cases of complete ablation of one posterior cerebral lobe were presented, one showing preservation of the macula and one not! So we are still in doubt concerning bilateral representation. The paper was notable for the exquisite care with which the fields were taken and the elaborate efforts to prevent error.

A group of pituitary tumors was presented, in which the symptoms due to third and fifth nerves predominated because the tumors spread laterally and did not press upon the chiasm in the classic manner.

The possibility of a preoperative diagnosis of prechiasmal localized chronic arachnoiditis was pointed out by one essayist who showed how encephalographs might render the diagnosis at least very suggestive.

Interesting experiments were demonstrated to show the relationship of anterior pituitary tumor in the production of exophthalmos and the recurrence of this associated with hypoactivity of the thyroid. Unfortunately, section of the muscles in the early stage to determine their condition before late changes had set in were not shown. Perhaps they will appear in the publication of the paper to throw light on this controversial point.

The scientific exhibit was interesting, as always. The stereoscopic studies of the optic tracts and oculomotor system must have been coveted by every teacher, and it is to be hoped that copies will be available for instruction.

The Knapp medal was awarded to Dr. Frederick Davis of Madison, Wisconsin, for his splendid paper on optic-nerve tumors associated with von Recklinghausen's disease, read before the Section in 1939.

The Association for Research in Ophthalmology voted a $100 prize for their excellent contribution to Kenneth C. Swan, M.D., and William Hart, M.A., Department of Ophthalmology, University of Iowa, for work on "A comparative study of the effects of mecholyl, doryl, eserine, pilocarpine, atropine, and epinephrine on the blood-aqueous barrier."

Albert Snell of Rochester, New York, was elected chairman of the Section for 1941; Edwin M. Neher of Salt Lake City, vice-chairman; and Derrick Vail of Cincinnati, secretary. The next meeting will be held in Cleveland.

The meeting was distinctly a good one. New York is always exciting to the visitor. Excellent shows and shops are to be seen and this year a World's Fair thrown in! There are the delightful foreign cafés, French, Italian, Swedish, or what-you-wish. Our hospitable local group also did much to make happy the stranger within the gates. Yes, thank you, we shall hope to call again!

Lawrence T. Post.

BOOK NOTICES

PATHOLOGICOANATOMIC OBSERVATIONS ON THE RELATIONS OF THE VASCULAR SCLEROSIS OF THE EYE TO ARTERIOSCLEROTIC CHANGES IN THE BRAIN, HEART, KIDNEYS, AND IN THE LARGE ARTERIES OF THE BODY. By F. Rintelen. 48 pages. A table of the cases studied. Supplement to Ophthalmologica, S. Karger, Basel, 1939.

On 45 cadavers of patients with only senility, general arteriosclerosis without hypertension, hypertension with vascular, contracted kidney, and arteriosclerosis with hypertension, and several with "normal vessels," examinations that were partly macroscopic and partly histologic were carried out as to the condition of the arterial system in the eye, brain, heart, and kidneys as well as in the large arteries of the body. Upon the basis of these examinations, it was definitely shown that where sclerotic changes were present in the retinal arteries, one was not warranted in concluding that a similar condition was present in the vessels of the brain. In the most intense retinal sclerosis, the basal vessels of the brain as well as the small arteries of the brain of the same size as those of the retina, not infrequently presented no sclerotic changes. In addition, and from the other standpoint, in cases of the most intensive sclerosis of the basal arteries or the small vessels of the brain, sclerotic changes in the retina might be entirely absent. On the other hand, it was found that where serious sclerotic changes were present in the retinal arteries, it was very probable that an arteriosclerosis of the kidneys also existed, as a rule arteriosclerotic contracted kidneys. The retina is therefore not a mirror of the brain but of the kidneys. In 5 or 6 patients with apoplexy, there was found an advanced retinopathia hypertonica. Not infrequently, in these cases, a sclerosis of the basal arteries or of the small arteries of the brain was completely absent.

H. D. Lamb.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP
ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

5
CONJUNCTIVA

Lieto Vollaro, A de. **Diathermy-coagulation treatment of trachomatous pannus.** Rassegna Ital. d'Ottal., 1939, v. 8, Nov.-Dec., p. 619.

Direct diathermy coagulation of pannus results in minute opacities, some necrosis of corneal tissue, and irregular astigmatism. In order to avoid these, the author practices an original procedure, with favorable results. The conjunctiva of the globe is picked up opposite the lower border of the pannus on the temporal side and is buttonholed by scissors. The conjunctiva is then separated up to the fornix, leaving a broad bridge. Glass rods are inserted beneath the conjunctiva and a current of 80 to 100 ma. is applied for one second, until the whole region has turned a grayish-white color. By this means the large blood vessels are completely obliterated, and the pannus gradually clears. Stereoscopic pictures of the change in the cornea from one week to one year after the operation show plainly the clearing process. (9 figures.) Eugene M. Blake.

Markus, I. M. **Cytologic investigations and pathogenesis of vernal catarrh.** Viestnik Opht., 1939, v. 15, pt. 5, p. 16.

A review of the literature and an investigation of sixteen cases. The author considers the cytologic triad of eosinophiles, monocytes, and histiocytes characteristic of the picture of vernal catarrh, and the basis of the allergic character of the disease.

Ray K. Daily.

Pŏstić, Svetozar. **The importance of the Weil-Félix reaction in trachoma and its bearing on the rickettsian etiology of trachoma.** Rev. Oto-Neuro-Oft., 1939, v. 14, May, p. 126. (See Amer. Jour. Ophth., 1939, v. 22, Feb., p. 217.)

Shroff, C. N. **Advancement of levator palpebrae muscle with tarsectomy as a permanent cure of trachoma in late stages.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 78-82.

A report of two hundred operations performed during the past 15 years on the lids for the permanent cure of trachoma in its late stages. The author states that the orbicularis muscle in trachoma is kept in a state of spastic hypertonicity through constant reflexes from the diseased conjunctiva. This causes increased lid tension and impaired lymphatic nutrition, and increases ulceration and pannus formation. The operation relieves the eyeball from the abnormal pressure by removing a considerable amount of tissue between the orbicularis muscle and the globe. The levator is detached from the upper border of the tarsus and attached to the lower border after removal of the greater portion of the tarsus. The author objects to operations which sacrifice the conjunctiva; conserving the conjunctiva maintains the nutrition of the lower border of the tarsus. In 80 percent of the cases the operation gave good results in curing entropion, ptosis, corneal ulcers, and pannus. Lawrence G. Dunlap.

6

CORNEA AND SCLERA

Corrado, M. **The histologic and etiopathogenic aspects of degenerative corneal changes.** Ann. di Ottal., 1939, v. 67, Dec., p. 881.

After reviewing the literature, the author gives a detailed description of his histologic findings in twelve cases. Ten of these were cases of absolute glaucoma and two were of iridocyclitis. A critical consideration is given each case from the viewpoint of its beginning, its evolution, and its histogenesis in connection with the coexistence of keratitis bullosa. (Bibliography.)

Park Lewis.

Gailey, W. W. **An efficient adjunct in the treatment of corneal ulcer.** Illinois Med. Jour., 1939, v. 76, Oct., p. 322.

Gailey believes that blocking the lacrimal sac with pontocaine ointment (2 percent) relieves pain and photophobia and hastens healing of the ulcer. This is because the nasal passages, which may be the source of the infection, do not continue to pour their secretion into the conjunctival sac.

Theodore M. Shapira.

Gamble, R. C. **Keratomalacia and cystic fibrosis of the pancreas.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 539-544; also Trans. Amer. Ophth. Soc., 1939, v. 37, p. 229.

Kolenko, A. B. **Corneal immunity.** Viestnik Opht., 1939, v. 15, pt. 5, p. 51.

This is a report of a laboratory study on local immunization of the corneae of rabbits against staphylococcus aureus. The results show that the injection of small doses produces an immunity lasting one year. The investigations point to the future possibility of prophylactic immunization against external ocular diseases. Ray K. Daily.

Kruse, H. D., Sydenstricker, V. P., Sebrell, W. H., and Cleckley, H. M. **Ocular manifestations of ariboflavinosis.** Public Health Reports, 1940, v. 55, Jan. 26, p. 157.

Nine adults were studied, all showing ocular changes. The principal defect found was keratitis. Slitlamp examination revealed superficial capillary proliferation, which was followed by proliferation in the substantia propria. Anastomosis of new capillaries from distant parts of the cornea occurred and this change was followed by infiltration with exudates in the super-

ficial proliferation. Superficial and deep opacities were seen. Riboflavin therapy brought about prompt recovery with remarkable corneal clearing in the active cases; in some there was entire disappearance of the opacity. Two cases with severe interstitial keratitis associated with lues showed very marked improvement while under riboflavin therapy. F. M. Crage.

La Rocca, V. **An original method for suturing corneal transplants.** Trans. Ophth. Soc. United Kingdom, 1939, v. 39, pt. 2, p. 739.

Before the cornea is cut, a continuous silk suture is passed through the episcleral tissues at the limbus in such a manner that it forms the sides of a hexagon. Sufficient slack is left for the loops to extend to the margin of the graft. A second suture is then passed so as to pick up the loops, pulling them together as a draw-string after the graft and the egg membrane are in place. This provides uniform pressure on the cornea and graft, and eliminates the danger of overlapping margins.

Beulah Cushman.

Medvedev, H. I., and Zatz, L. B. **Clinical material in corneal transplantation for 1935-1937.** Viestnik Opht., 1939, v. 15, pt. 5, p. 6.

A review of the literature and an analysis of 22 transplantations. A functional result was obtained in one case, and transparent grafts in two.

Ray K. Daily.

Thomas, J. W. **Some successful corneal grafts.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 731.

Successful corneal transplants are reported in nine patients, making a total of nearly seventy operations the author has performed since 1933. The technique is the same as that described at the Oxford Congress in 1937. (Amer. Jour. Ophth., 1938, v. 21, p. 1052). The results showed improvement even to the extent of 6/6 vision. One patient 72 years old was improved to 6/12. The blood-grouping of donor and recipient bore no relation to the success of the corneal grafts.

Beulah Cushman.

Zchuk, H. F. **Corneaxisis in trachoma.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 65.

Under this term, the author describes a procedure which consists of curettage of the corneal pannus, section of the conjunctiva at the limbus, and excision of the subconjunctival and episcleral tissue. The procedure is most effective for trachomatous pannus with moderate subconjunctival infiltration. In some cases, the corneal surface became covered with dot-like infiltrates, after the operation, but these promptly disappeared. The operation is indicated in trachoma resistant to medicinal agents. In trachoma complicated by scrofulosis the procedure may lead to intensification of the trachomatous process. Ray K. Daily.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Adrogué, Esteban. **Motility of the iris. Pathological alterations.** Arch. de Oft. de Buenos Aires, 1939, v. 14, March, p. 242.

A treatise upon the innervation of the iris and normal and abnormal pupillary responses. Edward P. Burch.

Bencini, Alberto. **Clinical-histologic-therapeutic considerations on six cases of sympathetic ophthalmia.** Boll. d'Ocul., 1939, v. 17, May, pp. 321-356.

The sympathetic ophthalmia manifested itself after either a perforating wound of the eyeball or a perforating corneal ulcer in six patients whose ages ranged from 6 to 66 years. Four of the patients were males. The symptoms appeared from 15 days to 9 months after the original lesion. In four cases the sympathetic symptoms appeared before enucleation of the exciting eye and 11 and 12 days later respectively in the other two. In all cases the clinical diagnosis was confirmed by histologic examination. The writer believes the process is due to a neurotropic virus. Treatment consisted of intravenous injections of urotropin and sodium salicylate. Four of the patients regained their full vision. (Bibliography, 16 figures.)

M. Lombardo.

Duggan, J. N. **Uveitis.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 22-31.

The etiology of anterior uveitis is discussed from both a geographic and infectious viewpoint. The thesis is developed that toxins can produce sensitization in the eye tissues.

Lawrence G. Dunlap.

Kaul, S. N. **Uveitis.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 39-41.

Of 35 cases seen during the two previous years, the etiology was given as syphilis in 48.5 percent, tuberculosis in 25.7 percent, gonorrhea in 5.7 percent, trauma in 5.7 percent, leprosy in 2.8 percent, and undiagnosed 11.1 percent. Lawrence G. Dunlap.

Lotin, A. V. **A case of essential progressive atrophy of the iris.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 113.

A woman 31 years of age had progressive atrophy of an iris segment, beginning at the pupillary margin and advancing toward the root. General examination revealed an otosclerosis and hypogenitalism. The author concludes that the basis of the iris atrophy was a troponeurosis due to a neurovegetative neurosis and endocrine disturbance. Ray K. Daily.

Ratnakar, R. P. **Uveitis.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 32-38.

The author emphasizes the role of tuberculosis in uveitis and gives his experience in its treatment with tuberculin. He is inclined to believe that in India as in Europe the tubercle bacillus or its toxin is a common cause of uveitis. Tuberculosis is estimated to be the cause in 25 percent, and venereal disease in 50 to 60 percent, septic foci and other endogenous factors being responsible in the remaining cases.

Lawrence G. Dunlap.

Refatullah, M. **Some clinical observations of uveitis in the eye infirmary, Medical College Hospitals, Calcutta.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 42-58.

The author stresses the allergic mechanism rather than bacterial metastasis.

Chronic uveitis is chiefly due to focal infection, especially in the paranasal sinuses and tonsils, and less frequently in the teeth and gastrointestinal tract. Following injury and focal sepsis, syphilis, tuberculosis, and gonorrhea are given in that order as etiologic factors in uveitis. Of 437 cases of uveitis seen in 1937, 247 were due to injury, both penetrating and nonpenetrating, 65 followed intraocular operations, and 42 followed couching and irritant drugs. Of the remaining 83 cases 46 percent were due to focal sepsis, 18 percent to syphilis, 5 percent to tuberculosis, 7 percent to gonorrhea,

2 percent to leprosy, and 5 percent were of undetermined cause.

Lawrence G. Dunlap.

Spiegel, E. A., and Scala, N. P. **Role of the cervical sympathetic nerve in the light reflex of the pupil.** Arch. of Ophth., 1940, v. 23, Feb., pp. 371-376.

Section of the cervical sympathetic nerve slightly impairs the ability of the pupil to dilate in the dark, but this may transitorily be abolished by the instillation of benzedrine sulphate into the conjunctival sac. After section of the oculomotor nerve, changes in the diameter of the pupil in the light and in the dark could not be noticed, and the electrosympathicogram of curarized cats was not changed either by illumination of the retina or by interruption of the illumination. This indicates that the cervical sympathetic nerve participates in the light reflex of the pupil only to the extent that its continuous impulses maintain a tonic contraction of the dilator muscle which enhances the effect of relaxation of the sphincter in the dark; there is, however, no definite increase of excitation of the nerve in the dark. It is concluded that the pathologic basis of the phenomenon of the Argyll Robertson pupil should be sought not in an impairment of the dilator innervation but in that of the reflex apparatus inducing contraction of the sphincter muscle.

J. Hewitt Judd.

Srinivasan, E. V. **Uveitis etiology.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 1-21.

Many causes are given which are rarely or never seen in America and Europe. Two or more diseases may be present at the same time and in each case a differential diagnosis should be made as to the particular disease or infection causing the uveitis. The relative frequency of alleged causes varies enormously in different parts of the world, syphilis being rated 70 percent by some and 20 percent by other writers. No lesion can be diagnosed with absolute certainty as tuberculous until the eye is removed and sectioned or until inoculation of material produces tuberculosis in animals. Traumatic uveitis in an apparently healthy person must be viewed as possibly tuberculous.

Lawrence G. Dunlap.

Veer, J. A. de. **Endophthalmitis phacoanaphylactica and its relation to sympathetic ophthalmia.** Arch. of Ophth., 1940, v. 23, Feb., pp. 237-252. (See Section 9, Crystalline lens.)

8

GLAUCOMA AND OCULAR TENSION

Alvis, E. B. **The effect of splenic extract on chronic simple glaucoma.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 529-531.

Barbel, I. E. **Color perception in glaucoma.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 10.

The objective of this laboratory study was to determine whether color-perception tests could be used to indicate changes in the vegetative system in glaucoma. The studies were made on 102 glaucomatous eyes. The results indicated that 34 eyes had disturbances of varying degree in color perception; parallelism in these disturbances and in those of other ocular functions could not always be demonstrated. Color-perception disturbances, demonstrable only when the patient was fatigued, were found frequently after administration of cervical diathermy or other forms of treatment affecting the nerv-

ous system. The author attributes this color asthenopia to the instability of the neurovegetative system. The investigation demonstrated that in the majority of cases of early glaucoma color tests evoke a normal response. Under the influence of fatigue, however, the instability and inadequacy of color perception can be clearly shown.

Ray K. Daily.

Bronstein, A. I. **The effect of light on intraocular tension.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 29.

In a laboratory study on rabbits it was shown that the customary drop in intraocular tension as a response to light did not take place either after section of the optic nerve or after section of the cervical sympathetic. However, the size of the pupil, controlled by atropine or adrenalin, had no effect on this process; section of the extraocular muscles was also without effect; thus showing that the drainage of fluid from the eyeball is independent of either the size of the pupil or the tension of the extraocular muscles. These findings indicate that the drainage of fluid from the eyeball is regulated by a reflex mechanism connected with the light-perception elements. The effect of the sympathetic nervous system suggests the possibility that the difference in reaction of the healthy and glaucomatous eye is due to a difference in the state of sympathetic innervation.

Ray K. Daily.

Gifford, S. R. **Treatment of secondary glaucoma.** Arch. of Ophth., 1940, v. 23, Feb., pp. 301-315; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1939, 90th mtg, p. 450.

The discussion includes the treatment for glaucoma secondary to injury, uveitis, cataract extraction, discission, thrombosis of the central retinal vein, subluxation of the lens, cycloplegia, serpent ulcer, radium therapy, and rosacea keratitis, and is based on observations in seventy cases. It is pointed out that each case requires individual treatment according to the clinical indications. Early recognition is very important. Miotics including mecholyl should be tried. Epinephrine and its derivatives, though dangerous during active iridocyclitis, are often of value in glaucoma following cataract extraction or discission. Intravenous injection of a hypertonic solution may obviate paracentesis in many cases. When the tension could not be controlled by other means, the operations which proved to be of most value in this series were: iridectomy for glaucoma following uveitis, and cyclodialysis for glaucoma following cataract extraction or discission. (Discussion.)

J. Hewitt Judd.

Gjessing, H. G. A. **On Holth's iridencleisis antiglaucomatosa. Post examination of 198 iridencleises ad modum Holth in chronic glaucoma, 6 to 280 months after the operation.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 1, p. 311.

After following his cases the author concludes that in the treatment of acute glaucoma an iridectomy is indicated. In chronic glaucoma, even if the pressure stays a little above normal, no operation is indicated so long as the field does not change. If the field shrinks iridencleisis should be performed immediately.

The technique of the operation is given. A summary of 198 cases in which iridencleisis had been performed shows that the intraocular pressure had returned to and remained normal without use of miotics in 144, the vision

was unchanged or improved in 159, and the fields were preserved or even improved in 170 cases. (Illustrations.)

Beulah Cushman.

Klachko, W. L. **Material for the study of juvenile glaucoma.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 80.

On the basis of the literature and his own observations, the author proposes to classify juvenile glaucoma into two types. One type is clinically similar to senile glaucoma. The other type is associated with hypoplasia of the iris; clinically it is characterized by rapid progression and the absence of inflammatory phenomena. The grave cases of glaucoma are usually those associated with hyperplasia of the iris or rudimentary hydrophthalmos.

Ray K. Daily.

Mairova, O. A., and Glikina, E. C. **Early diagnosis of glaucoma by means of provocative tests.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 120.

Fifty-seven patients were subjected to the Seidel, Schmidt, and Thiel tests. The author concludes that the Seidel and Schmidt tests are more effective but that all three should be used in each patient. The reactions to the various tests were inconstant because glaucoma patients have an unstable nervous system; in only a few cases were all three tests positive. Ray K. Daily.

Protopopov, B. V. **Intracutaneous absorption in glaucoma patients.** Viestnik Opht., 1939, v. 15, pt. 5, p. 31.

The objective of this study was the demonstration of the relation of glaucoma to thyroid function. Fifty glaucoma patients were tested for the rapidity of absorption of 2 c.c. of normal saline, introduced intracutaneously according to the method of Aldrich and McClure. The prolonged absorption time found in these patients was indicative of a hypothyroidism. In fifty cataract patients the absorption time was mostly normal. Ray K. Daily.

Uribe Troncoso, M. **Cyclodialysis with insertion of a metal implant in the treatment of glaucoma; a preliminary report.** Arch. of Ophth., 1940, v. 23, Feb., pp. 270-300; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1939, 90th mtg, p. 389.

A strip of magnesium was implanted in the wound between the ciliary body and the sclera. There was, at first, a mild reaction to the foreign body with numerous bubbles of free hydrogen appearing in the anterior chamber and under the conjunctiva. The reaction subsided in about one week, and the metal was entirely reabsorbed at the end of twenty days. The presence of the metal and the bubbles of gas prevented the reattachment of the ciliary body to the sclera, thus affording a new way for the outflow of the aqueous into the suprachoroidal space. Experiments on animals and microscopic sections have shown that a lacunar space is formed between the anterior chamber and the suprachoroidal space, ending in a thin scleral cicatrix. There is never a complete channel. Implantation of magnesium after cyclodialysis was made in 12 human eyes with subacute, chronic congestive, simple, or congenital glaucoma. In all but three cases previous operations had been done by other methods, several times with poor results. Clinical results were good in a majority of cases, in others there was improvement with diminution of hypertension, and in one case no improvement occurred. The method is harmless and can be repeated several times in the same eye. (Discussion.)

J. Hewitt Judd.

9

CRYSTALLINE LENS

Archangelskii, V. H. **Mutations in the lenticular epithelium.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 6.

The author believes that the epithelium of the lens is especially suitable for the study of epithelial properties, because of its isolation from mesodermic structures and its failure to participate in processes of adjoining tissues, so long as the capsule remains intact. The transition of epithelial cells into fibroblast and osteoid tissues can be demonstrated in the lenticular epithelium. Photomicrographs illustrate the changes in the capsular epithelium in morgagnian cataract and in cataract secondary to uveitis, neoplasms, or glaucoma. Ray K. Daily.

Ferrer, Horacio. **New apparatus for the extraction of cataract by suction.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 550-554.

Harman, N. B., and Buxton, R. **Dislocation of the lenses, with other congenital defects: secondary glaucoma.** Brit. Jour. Ophth., 1940, v. 24, March, pp. 135-136.

A case is reported of an only child of normal parents. At the age of three the boy was found to be shortsighted; at five he was fitted with glasses. At seven it was observed that there was a severe degree of metatarsus varus in both feet, and that his general physique and posture were bad. The depth of the anterior chamber indicated lenticular dislocation and this became markedly apparent later. As he advanced in age he was unsteady as to gait, suffered from phlebitis in both legs, and had epileptic fits. Acute glaucoma developed at the age of 19 years. Procedures of treatment for the ocular condition are described. D. F. Harbridge.

Olmos, E. S. **Sclerocorneal anchorage in the cataract operation.** Anales de la Soc. Mexicana de Oft., 1939, v. 14, July-Sept., pp. 153-158.

The author uses a preliminary suture in the shape of a "W," with three punctures of the sclera and two of the cornea; first running through the sclera parallel to the limbus, then through the cornea parallel to the limbus, then again through sclera, cornea, and finally sclera. Greater protection against the escape of vitreous and against postoperative astigmatism is claimed.

W. H. Crisp.

Orzalesi, F. **Respiration and glycolysis of cataractous lenses.** Boll. d'Ocul., 1939, v. 17, May, pp. 357-372.

As a result of experiments performed on extracted human cataracts the writer states that reduced respiratory activity is due to the proportion of lens fibers still transparent; the lowering or abolition of glycolytic power is mainly related to the reduction of the enzyme content in old patients in association with the increase of the calcium content of the lens. (Bibliography.)

M. Lombardo.

Philps, A. **Postcataract hyphema.** Brit. Jour. Ophth., 1940, v. 24, March, pp. 122-135.

In 374 consecutive cataract extractions there was a 13.13-percent incidence of hyphema; 85 percent of these came from the section, the remainder from the iris and conjunctival flap. It is the opinion of the author that neither the type of operation nor the presence of diabetes or hypertension has any influence on hyphema, but that trauma from squeezing the lids is causative.

This may be prevented by the use of a corneoscleral stitch. Photomicrographs illustrate the contention that the aqueous humor has no action on red cells but dissolves fibrin from the clot, and that the cells are absorbed by the iris and do not enter the canal of Schlemm to any appreciable degree. A review of the literature is included. (Photomicrographs, tables.) D. F. Harbridge.

Pignalosa, G. **The metabolism of phosphorus in the crystalline lens in normal and in parathyroidectomized rabbits.** Ann. di Ottal., 1939, v. 67, Dec., p. 927.

The author determined the phosphorus content of the lenses in normal and parathyroidectomized rabbits. The amount was found to be larger in the normal group and in these the lens substance was evidently capable of forming phosphorus esters from glucose. This function, which was clearly diminished in the animals which had been operated upon, had an evident connection with the permeability of the capsule. The author attributes the diminution to probable postoperative reduction of certain enzymes. (Bibliography.) Park Lewis.

Selle, R. M. **Failure of galactose given subcutaneously to produce cataract in rats.** Arch. of Ophth., 1940, v. 23, Feb., pp. 369-370.

Rats were given 2 c.c. of a 50-percent solution of galactose subcutaneously each day for 120 consecutive days without producing cataract as far as could be determined with the ophthalmoscope. J. Hewitt Judd.

Veer, J. A. de. **Endophthalmitis phacoanaphylactica and its relation to sympathetic ophthalmia.** Arch. of Ophth., 1940, v. 23, Feb., pp. 237-252.

After reviewing the literature the author reports three cases with a description of the histologic changes in the enucleated eye in each. These findings support the hypothesis that a phacoanaphylactic reaction occasionally is the precursor of sympathetic ophthalmia. Since there is much evidence supporting the allergic theory of etiology as opposed to the infectious and toxic theories, and since Burky has developed an effective means of desensitization, it is suggested that prevention and even cure of phacoanaphylactic reactions through desensitization may result in the reduction of the incidence of sympathetic ophthalmia, especially that following cataract extraction.

J. Hewitt Judd.

10

RETINA AND VITREOUS

Batarchukov, P. A. **Retinal changes following loss of blood, and their reaction to transfusion.** Viestnik Ophth., 1939, v. 15, pts. 3-4, p. 23.

A review of the literature and the report of a case. The patient, 33 years old, had a severe hemorrhage during a curettage for an incomplete abortion. Soon afterward she came to the eye clinic complaining of loss of vision in both eyes. Both fundi presented a picture of posthemorrhagic ischemia and retinal angiospasm. She was given a 250-c.c. blood transfusion. Her visual acuity improved immediately, and the visual fields extended slowly; the retinal edema subsided and the final result was good. The author recommends a prophylactic transfusion in all cases of severe hemorrhage. Ray K. Daily.

Bedell, A. J. **An exposition of some round macular lesions.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 520-529;

also Trans. Amer. Ophth. Soc., 1939, v. 37, p. 185.

Boros, Béla. **Retinitis stellata in connection with focal infection.** Brit. Jour. Ophth., 1940, v. 24, March, pp. 137-139.

Retinitis in which a star figure at the macula occurs is commonly seen accompanying nephritis, but can also occur with other conditions. Leber noted its occurrence as an idiopathic type in young individuals, following influenza, accompanying chlorosis, and as a result of embolus or thrombosis associated with circulatory disturbances. Other cases of retinitis stellata have been attributed to tuberculosis, meningitis, brain tumor, and head injury. The author reports a case in which dental infection was the apparent cause, and he suggests investigation of the teeth in all such cases of retinitis.

D. F. Harbridge.

Iofe, A. M. **Pathogenesis of retinal periphlebitis with recurrent hemorrhages.** Viestnik Opht., 1939, v. 15, pt. 5, p. 39.

A review of the literature and an analysis of the author's own material. Iofe supports Axenfeld's opinion that the disease is of tuberculous etiology.

Ray K. Daily.

Lijo Pavia, J. **Vitreous humor, bilateral symmetrical formations and intrinsic shadows on the retina.** Rev. Oto-Neuro-Oft., 1939, v. 14, April, p. 97.

The author adds to the literature his second case, which occurred in a 73-year-old diabetic with advanced vascular changes in the retinal circulation. The lesions, which were symmetrical, consisted of vitreous corpuscles occurring about 7 D. in front of each disc. They were approximately circular, grayish, and about the size of a large blood vessel. By retinography the shadows could be seen projected upon the retina. The speculation is that they represent a remnant of the hyaloid system.

Edward P. Burch.

Rosenthal, C. M., and Seitz, C. P. **Alterations in angioscotomas following the oral administration of benzedrine sulphate.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 545-549.

Samuels, Bernard. **Drusen of the retina: a clinical and pathological study.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 715.

The author reports on eight pathologic specimens which were found in phthisic eyes. The drusen were derived from cells of the pigment epithelium that had wandered into the retina or they had originated in the degenerated walls of retinal blood vessels. Genuine drusen were also found in retinae which presented gliomatosis.

Samuels states that drusen may be produced from mesodermal tissue as hyaline bodies in an old corneal scar, and from ectodermal tissue as drusen of the choroid, and he concludes that the neuroglia of the retina (another form of ectoderm) may produce the same result. (Illustrations.)

Beulah Cushman.

Schupfer, Francesco. **Studies on the behavior of the light sense of exophthalmic-goiter patients in relation to carotinemia and vitaminemia.** A. Boll. d'Ocul., 1939, v. 17, May, pp. 390-421.

The light sense of 25 patients affected by exophthalmic goiter was tested in order to determine whether hypovitaminosis-A was present. The ages ranged from 24 to 72 years. Some of the patients showed a pathologic

diminution of the light sense. This, however, could not be related in all cases solely to a vitamin-A disturbance.
M. Lombardo.

Sorsby, Arnold. **Vital staining of the fundus.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 727.

Vital staining of the central nervous system with a nontoxic dye establishes the fact that though the normal retina decolorizes any dye that reaches it, the damaged retina has that capacity to a much smaller extent and becomes stained. With the doses used so far for intravenous injection, an atrophic or inflamed disc stains readily, as do also exudates and perivascular white streaks. Tears and holes in the retina are readily seen. Beulah Cushman.

Vorobiev, I. F. **A case of Coats's exudative retinitis, simulating a neoplasm of the choroid.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 45.

The microscopic picture showed a profuse serofibrinous exudate in the retina (most pronounced posteriorly), hemorrhages, perivascular infiltration, newly formed and hyalinized connective tissue, and proliferation and migration of pigment. The choroid was not involved. Ray K. Daily.

Wortis, S. B., and Shaskan, D. **Retinitis pigmentosa and associated neuropsychiatric changes.** Jour. Amer. Med. Assoc., 1940, v. 114, May 18, p. 1990.

The authors studied 41 patients with retinitis pigmentosa coming from 31 families and 33 sibships; in 18 of these families more than one member was affected. Consanguinity was present in two families. Three fifths of the patients were males and two fifths of them were deaf. Other somatic and psychologic defects were commonly found, including mental retardation, schizophrenia and auditory hallucinations, convulsive disorders, and associated changes such as persistent amenorrhea, polydactylism, obesity, and thyrotoxicosis. The authors further note that these patients make a happy social adjustment in spite of their visual disturbances, but if deafness precedes the blindness they may have mild paranoid changes. There is biologic evidence of a general metabolic disturbance in patients suffering with retinitis pigmentosa. (2 charts, bibliography.)
George H. Stine.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Weskamp, R. L. **Evolution and prognosis of papilledema.** Arch. de Oft. de Buenos Aires, 1939, v. 14, April, p. 303.

A discussion on the development and prognosis of choked disc occurring as an ocular manifestation of such diverse conditions as brain abscess, intracranial sinus thrombosis, brain tumor, central-nervous-system lues and tuberculosis, and cerebral hemorrhage, with notes on the medical treatment of the condition. Edward P. Burch.

Wetzel, J. O., and Moore, L. A. **Blindness in cattle due to papilledema.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 499-513.

12

VISUAL TRACTS AND CENTERS

Balado, Manuel. **Comments on the present knowledge of the functional anatomy of the external geniculate body of man.** Arch. de Oft. de Buenos Aires, 1939, v. 14, March, p. 205.

A very complete summary of our present-day knowledge of the correla-

tion between function and the segmental structure of the human external geniculate body, based largely upon quantitative clinical perimetric findings, subsequently substantiated by operative or post-mortem studies. (Illustrated.) Edward P. Burch.

Mayer, L. L. **The optic pathway.** Arch. of Ophth., 1940, v. 23, Feb., pp. 382-394.

Because three-dimensional relation of the optic pathway to the brain is difficult to demonstrate to students, a special model has been constructed upon the basis of photographs and mounts at various levels in the brain. These sections are uniformly numbered throughout the series, and certain letters are added to keep the continuity. A detailed study of the model on anatomic as well as on physiologic lines gives a clear conception of the optic pathway and its environs, and allows correlation of the classic field defects caused by lesions in various portions of the pathway. The anatomy of the optic pathway is described, tracing it in an anteroposterior direction from the eye to the occipital cortex. The article is well illustrated by drawings.

J. Hewitt Judd.

Williamson-Noble, F. A. **The ocular consequences of certain chiasmal lesions.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 627.

The author discusses chiasmal lesions of various types and summarizes the characteristics of each. The meningioma syndrome has its onset usually in middle age with impairment of vision the earliest and often the only symptom. Bitemporal asymmetrical field losses are the rule, and the discs are bluish-white with clear-cut edges and vessels of normal caliber, except in advanced cases where papilledema has supervened. Prechiasmal tumors of congenital formation due to failure of closure of the hypophyseal duct are characterized by simple atrophy of the discs on one side and later papilledema on the opposite side.

Chiasmal arachnoiditis may develop by direct involvement through the lamina cribrosa of the ethmoid, through lymphatics which connect the sinuses with the subarachnoid space, and from the brain by way of the perivascular lymphatics and the blood vessels. Adhesions, which are fixed to the large neighboring arteries, cause compression or traction of the nerves or chiasm and later interfere with the blood supply. The field changes in this type of involvement may be pleomorphic. The rapid and early diminution of vision and almost simultaneous appearance of edema and atrophy of the disc, associated with a negative systemic-neurologic examination, are characteristic of arachnoiditis. The surgical treatment of these adhesions gives brilliant results and one case of Leber's disease is reported as healed.

Aneurisms usually develop at the bifurcation of a large vessel and roentgen examination reveals a normal sella with a fine shell of calcification above it. The field defects may be bitemporal with inferior quadrantic loss associated with pain and ocular palsies.

Gliomata of the chiasm are rare and are associated with slow and progressive loss of vision affecting both eyes, although one may be unaffected for a longer time. The field defects are usually ill-defined due to the infiltrating characteristics in contrast to pressure lesions. This condition is frequently associated with evidences of a generalized neurofibromatosis, and roentgen

examination reveals enlarged optic foramina. (Illustrations.)

Beulah Cushman.

13

EYEBALL AND ORBIT

Emiliani, C. M., and Bisi, R. **Abscess at the vertex of the orbit following ethmoidectomy.** Rev. Oto-Neuro-Oft., 1939, v. 14, April, p. 106.

Case report of an orbital abscess following partial ethmoidectomy in a man of 55 years. Exploration revealed the abscess to be at the apex of the orbit. It was successfully opened and drained, but without benefit to the vision, which had failed as a result of optic neuritis. Edward P. Burch.

Hagedoorn, A. **Plastic restoration of a deformity caused by complete exenteration of the orbit.** Surg., Gyn., and Obstet., 1940, v. 70, Feb. 1, p. 193.

In a recent case of complete exenteration, with only the skin of the eyelids preserved, the method used involved a four-stage operation wherein by means of free and pedunculated fat transplants the orbit was prepared for an Esser-Wheeler operation. A description is given of the technique used. (Photographs, drawings.) F. M. Crage.

Hardy, Guerdan. **Orbital cellulitis simulating acute dacryocystitis.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 562-563.

Orlov, K. X. **Pathology and therapy of thrombosis of the orbital veins and venous sinuses of the skull.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 140.

A review of the literature and a report of three fatal cases.

Ray K. Daily.

Reese, A. B. **Unilateral exophthalmos and its surgical treatment.** Pennsylvania Med. Jour., 1940, v. 43, Feb., p. 605.

Reese analyzed 161 consecutive cases after ruling out proptoses due to unilateral myopia of 25 to 30 D., early hyperthyroidism, and paralysis of or operations upon the recti muscles. The most common causes were hemangioma of the orbit, mixed tumor of the lacrimal gland, nasopharyngeal lesions, sinus lesions, and extensions from new growths in the eye or lids. Diagnosis is aided by X ray, biopsy, and aspiration biopsy. Treatment consists of local excision of the lesion producing the proptosis, enucleation with local excision, or exenteration of the orbit.

Theodore M. Shapira.

Rubens, Eli. **Hereditary cleidocranial dysostosis with features of ocular hypertelorism.** Arch. of Pediatrics, 1939, v. 56, Dec., p. 771.

Rubens reports two cases in which the family history could be traced back for five generations; the condition seemed to be transmitted as a dominant mendelian factor. Characteristics included wide separation of the eyelids, a brachycephalic skull, a large cranium, a small face, and a broad-bridged retroussé nose.

Theodore M. Shapira.

Schupfer, Francesco. **Studies on the behavior of the light sense of exophthalmic-goiter patients in relation to carotinemia and vitaminemia A.** Boll. d'Ocul., 1939, v. 17, May, pp. 390-421. (See Section 10, Retina and vitreous.)

Taylor, W. O. G. **The effect of enucleation of one eye in childhood upon the subsequent development of the face.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 1, p. 361.

Fifty-one cases were investigated

from the Royal London Ophthalmic Hospital, the ages ranging from 3½ to 43 years of age and the interval since enucleation from 1½ to 38 years. The average length of time after enucleation was 6½ years. The author concludes that enucleation before the age of five years leads to a deficiency of the bony growth of the orbital margin which may be as much as 15 percent; this persists into adult life. Enucleation at nine years and after does not lead to appreciable alteration. The maxillary antrum on the anophthalmic side undergoes a slight overgrowth when enucleation is performed before the age of nine years, and this leads to diminution in orbital height and an alteration in the shape of the orbital margin. The use of a prothesis as a factor in the development of the bony parts has not been recognized, but a prothesis is necessary to mask any deformity present. Beulah Cushman.

Vishnevski, H. A. **Visual chronaxia in anophthalmos following enucleation.** Viestnik Opht., 1939, v. 15, pts. 2-4, p. 36. (See Section 3, Physiologic optics, refraction, and color vision.)

14

EYELIDS AND LACRIMAL APPARATUS

Butler, R. D. W. **Lexer's operation for ptosis.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 579.

The operation was first used by Lexer, a general surgeon, for correction of deformities following war injuries. A piece of fascia lata 2 inches long is removed, cut into strips 3/16 of an inch wide, and placed in an undermined area extending from the frontalis muscle to within 3 mm. of the lid margin. The condition should be undercorrected as the fascia lata contracts during the subsequent six weeks. The strips on the nasal side should be slightly tighter than those on the temporal. The advantages of the operation are that it is based on undercorrection, is suitable for any type of ptosis at any age, and (seemingly) avoids recurrences.

Beulah Cushman.

Doherty, W. B. **The treatment of chronic blepharitis with a modified Knapp roller forceps, and a 1-percent alcoholic solution of gentian violet.** Amer. Jour. Ophth., 1940, v. 23, May, pp. 567-568.

Kurlov, H. I. **Restoration of the lid in toto.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 103.

The author uses pedicle skin-transplants, mucous membrane from the lip, and cartilage from the ear. (Illustrations.) Ray K. Daily.

Poliak, B. L. **The effect of alcohol on the morphology and function of the lacrimal glands in epiphora.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 157.

One hundred patients with epiphora of varying etiology were treated with alcohol injections into the lacrimal gland. The author accepts this procedure as simple and harmless. The pain lasts about one minute, the edema three to seven days, and an occasional ptosis two weeks. The immediate effect is an improvement in the epiphora in 68 percent of cases. The improvement manifests itself within the first ten days, and in most cases is transitory, lasting from several weeks to one year; in only 12 percent of the cases did it continue over one year. Microscopic examination of the lacrimal glands showed no atrophy. Apparently the improvement is to be attributed to the effect of the injection on the secretory nerves. The pro-

cedure, which may be done repeatedly, is indicated in cases where other methods have proven ineffective. (Illustrations.) Ray K. Daily.

Spaeth, E. B. **The correction of massive defects of both eyelids.** Pennsylvania Med. Jour., 1940, v. 43, Feb., p. 663.

Spaeth presents 14 photographs and 12 diagrams illustrating plastic surgery of the eyelids. Theodore M. Shapira.

15

TUMORS

Alagna, Gaspare. **The pathogenesis of true subconjunctival lipomata.** Rassegna Ital. d'Ottal., 1939, v. 8, Nov.-Dec., p. 636.

True subconjunctival lipoma constitutes a well-defined ontologic entity which is clearly differentiated from all other corneoconjunctival teratomata in general and from lipodermata in particular. The author discusses various opinions regarding the origin of these tumors and reports the case of a 73-year-old man who presented bilateral, symmetrically placed tumors near the outer canthus. Two other lipomata were present in the body. He concludes that the subconjunctival lipomata arose from embryologic formations of adipose cells. The histopathology is described minutely. (2 figures, 2 colored designs.) Eugene M. Blake.

Cordes, F. C., and Hogan, M. J. **Angiomatosis retinae (Hippel's disease).** Arch. of Ophth., 1940, v. 23, Feb., pp. 253-269; also Trans. Pacific Coast Oto-Ophth. Soc., 1939, 27th mtg.

The clinical manifestations of the disease as found in the literature are summarized. The case is reported of a girl aged twenty years, in whom the condition was present in a fairly early stage, and who showed no evidence of angiomatous lesions elsewhere. High-voltage roentgen therapy caused a definite decrease in the size of the tumor and the amount of exudate by the end of seven months. However, based on the results in this case and those reported in the literature, it appears that localized radium therapy produces a greater effect upon the tumor mass than does roentgen radiation. It is suggested that electrolysis may become an accepted method of treatment.

J. Hewitt Judd.

Hirose, K., and Nagae, R. **Changes in the eyegrounds, and histologic examination of the eye in tuberous sclerosis.** Ann. d'Ocul., 1940, v. 177, Jan., pp. 1-16.

A 23-year-old Japanese with negative family history showed epileptiform convulsions, mental deficiency, and adenoma sebaceum of the face. On ophthalmoscopic examination both eyes presented the appearance of papilledema and there were multiple retinal hemorrhages in the left. The patient died from an intracranial hemorrhage not directly connected with the disease. At autopsy he was found to have the typical scattered tumor-formation of tuberous sclerosis in the brain and other organs. Examination of the eye, however, showed that what had been clinically interpreted as choked disc was really typical tuberous sclerosis tumefaction of both nerve heads. The tumor included many large neuroglial cells and an increase of glial fibers.

John M. McLean.

Love, J. G., and Rucker, C. W. **Meningioma of the sheath of the optic nerve.** Arch. of Ophth., 1940, v. 23, Feb., pp. 377-380.

A woman aged 48 years presented a benign growth on the sheath of the optic nerve. After unroofing a portion of the orbit and the optic canal, the tumor, the intracranial dura mater, and the sheath of the optic nerve were resected en masse. There was improvement in vision and increase in the visual fields postoperatively. Roentgenograms of the skull, including special views of the optic canals and lesser wings of the sphenoid bone, did not reveal any tumor, but the loss of vision and studies of the perimetric fields permitted early recognition and removal of the meningioma. J. Hewitt Judd.

Moorhouse, J. H. **Case of neurofibroma of the choroid of acoustic nerve type.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 1, p. 416.

Intraocular sarcoma was suspected in the right eye of a woman 43 years of age, and the eye was removed. Microscopic examination revealed a neurofibroma and subsequent general examination established a diagnosis of Recklinghausen's disease. The patient had two pigmented moles on her body. Beulah Cushman.

Pokrovskii, A. I. **Neoplasms of the orbit.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 146.

A review of the literature and a detailed report of three cases of mixed tumors of the lacrimal gland. The chief features of these epithelial tumors are their benign clinical course and the possibility of malignant transformation. For the latter reason the only sound therapy is early and complete extirpation. Ray K. Daily.

Rudenko, B. F. **A case of initial epithelioma of the limbus.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 169.

A report of a limbus neoplasm, considered by the author to be a transition stage which may lead to the evolution of a papilloma or carcinoma. Inasmuch as the microscopic picture gives no indication as to the final form of the neoplasm, thorough excision is indicated. Ray K. Daily.

Scardaccione, Mario. **Epithelioma of the meibomian glands with blastomatous manifestations in the tarsal conjunctiva and contact epithelioma of the cornea.** Boll. d'Ocul., 1939, v. 18, April, pp. 221-243.

After a blow on the left eye a woman 63 years of age developed swelling of the lower lid and diminution in vision of the same eye. Palpation showed a poorly delimited hard mass in the lid, and a tumor of the adjacent cornea was seen. Histologic examination revealed an epithelioma of the meibomian glands, an epitheliomatous metamorphosis of the tarsal conjunctiva, and an epithelioma of the cornea. The corresponding margin of the lid and fornix were not affected. The writer believes that the epithelioma originated in the tarsus, provoking an epitheliomatous proliferation in the tarsal conjunctiva, and producing the epithelioma of the cornea by a contact metastasis. (Bibliography, 7 figures.) M. Lombardo.

Smithers, D. W. **X-ray treatment of malignant tumors in the region of the eyes.** Brit. Jour. Ophth., 1940, v. 24, March, pp. 105-122.

Radium and X-ray treatment for malignancies of the eyes must be used with great caution and accuracy. Conjunctivitis, corneal ulcers, and later development of cataract are among the complications of treatment by radiation. New lead-covered contact shells for protection of the eye during such

treatments are described. Results obtained from radiation are outlined. (17 illustrations, figures, references.)

D. F. Harbridge.

Talkovskii, S. I. **Hippel-Lindau's disease.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 180.

Review of the literature and report of a case. (Illustrations.)

Ray K. Daily.

Tanner, J. W., and Hertzog, A. J. **Fibrosarcoma of the optic nerve.** Wisconsin Med. Jour., 1940, v. 39, Jan., p. 29.

The incidence, location, symptoms, and diagnostic points of importance of primary optic-nerve tumors are noted. The authors discuss a case of a large fusiform tumor arising from the distal portion of the optic nerve in a child of three years. Pathologic examination revealed a fibrosarcoma of low-grade malignancy. Uneventful recovery followed the removal of the eye and the orbital portion of the optic nerve.

F. M. Crage.

Tiscornia, A., Nano, H. M., and Lede, R. E. **Papillomatous epithelioma of the conjunctiva.** La Semana Med., 1940, v. 47, April 4, pp. 801-806.

The patient was a man of 49 years. For five months he had noticed a small swelling near the inner angle of the left eye, inside the lower lid. At the time of examination a red growth protruded between the free borders of the lids when the patient was requested to close his eyes. The mass was about of the size of a hazelnut, had an irregular surface, and was not ulcerated. The excised growth showed the typical histologic structure of a papillomatous epithelioma of the palpebral conjunctiva. Excision was followed by cauterization of the raw surface with the galvanocautery.

W. H. Crisp.

Tita, Carlo. **Primary glioma of the optic nerve with "meningiomatosis" of its sheaths.** Boll. d'Ocul., 1939, v. 17, April, pp. 271-307.

For three years a boy seven years of age had shown a progressive deviation of the left eye outward and upward, with some proptosis. The movements of the eyeball were very limited, the papilla was white, and the vision was nil. A very friable mass, 6 by 3.50 cm., was removed from the orbit; no trace of the optic nerve was found. By microscopic examination the mass was found to be an astrocytic, monobipolar spongioblastoma. A cellular proliferation of the inner sheath of the optic nerve was found to be a blastoma which the author calls a "meningiomatosis." (Bibliography, 25 figures.)

M. Lombardo.

Tzipenuk, L. M. **A case of cavernous angioma of the orbit.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 206.

Review of the literature and report of a case. A man 58 years old had a hemangioma of the right orbit with exophthalmos, choked disc, change in refraction of the eye, absence of pulsation, and marked engorgement on change in position. A Krönlein operation disclosed the tumor, which was tied at its base and removed.

Ray K. Daily.

16

INJURIES

Cardello, Giovanni, **Traumatic lacerations of the macula with partial return of function.** Rassegna Ital. d'Ottal., 1939, v. 8, Nov.-Dec., p. 711.

The author examined a 15-year-old boy immediately after he had been

struck in the zygomatic region by a large piece of stone. All of the internal structures of the eyeball were normal except the macula. Here there was a conspicuous red area about one half disc-diameter in size. The borders of the spot were raised and the surrounding retina was edematous. Vision was 1/10. The red area gradually cleared leaving a grayish-white spot with a clear yellow center. The final vision was 5/10. Whether there was direct contusion to the eye does not seem certain, but the recovery of so much central vision was considered unusual.

Eugene M. Blake.

Dollfuss, A., **Ocular complications of irradiation.** Ann. d'Ocul., 1940, v. 177, Jan., pp. 16-39.

This article is a long discussion of complications in the lids, conjunctiva, cornea, ciliary body, lens, retina, and optic nerve from various types of radiation in the neighborhood of the eye. (Bibliography.) John M. McLean.

Garden, R. R. **Blood-staining of the cornea.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 1, p. 465.

The author describes a blunt injury to the eye in a ten-year-old boy who developed a hemorrhage in the anterior chamber. Three weeks later the entire cornea was blood-stained but it cleared after 16 months.

Beulah Cushman.

Genet, L. **Rapidly progressive adhesive tenonitis simulating orbital phlegmon.** Bull. Soc. d'Opht. de Paris, 1938, March, p. 169.

A case report as described in the title. The condition followed a foreign-body injury, and the eye was enucleated on the fourth day.

George A. Filmer.

Klar, R. **Observations of corneal damage by novocaine and pontocaine.** Klin. M. f. Augenh., 1940, v. 104, Feb., p. 205.

Four cases are described in which corneal damage followed overdoses of novocaine (one case) and pontocaine (three cases) as local applications.

C. Zimmermann.

Lyon, M. B., and Miller, W. E. **Implantation epithelial cyst in anterior chamber.** Amer. Jour. Ophth., 1940, v. 23, April, pp. 449-452.

Palin, Anthony. **Foreign body removed by posterior route after precautionary diathermy.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 1, p. 465.

After an unsuccessful attempt to remove a small piece of steel from the vitreous with the giant magnet, the adjacent sclera was bared and an area was cauterized with Larsson's point as for a retinal-separation operation. Sutures were inserted and a perpendicular keratome incision was made through the sclera. The tip of a hand magnet was then introduced through this incision and the foreign body was easily removed. The recovery was uneventful and normal vision was obtained.

Beulah Cushman.

Sédan, Jean. **Alcohol treatment of corneal injuries from aniline pencils; clinical and experimental studies.** Ann. d'Ocul., 1940, v. 177, Feb., pp. 65-77.

Aniline pencils produce very serious corneal injuries and most cases result in loss of the eye. Literature to substantiate this observation is reviewed and one case is reported which was successfully treated by radical excision of the damaged tissue and subsequent treatment of the cornea with applica-

tions of absolute alcohol. Protocols of 14 animal experiments with aniline-pencil injuries are cited. The untreated eyes were lost, those treated with tannic acid were badly scarred, those treated with peroxide were also scarred, but those treated with alcohol responded fairly well. John M. McLean.

Sniderman, H. R. **Human bite of the eyelids.** Arch. of Ophth., 1939, v. 22, Nov., pp. 885-887.

After a thorough irrigation, an avulsive tear of the eyelids of a patient aged 48 years was closed with the insertion of a small drain. Postoperatively, the patient was given sulphanilamide by mouth and at the end of two weeks the wound was healed. Because of the extent of the wound, the usual treatment would not have been sufficient to avoid severe infection with destruction of tissue and disfiguration.

J. Hewitt Judd.

Svadoch, B. I. **Methods of visualizing the posterior ocular segment for the purpose of localizing foreign bodies within and without the eyeball.** Viestnik Opht., 1939, v. 15, pts. 3-4, p. 171.

Experiments were made with injections of sodium iodide, lipiodol, and sergosin into Tenon's capsule. Sergosin is a Soviet-manufactured preparation containing 52 to 56 percent of pure iodine in a fixed combination. The results of the investigation showed that reaction to injections or sergosin is rapidly transitory, and the injections have no effect on the adjoining tissues. Lipiodol reactions are prolonged, and unabsorbed masses of the substance can be demonstrated for a long time; in addition it has a toxic effect on the adjoining tissues. Ray K. Daily.

Zettl, Wolfgang. **Symptomatology and therapy of late damage to the eye by mustard gas.** Klin. M. f. Augenh., 1940, v. 104, Feb., p. 217.

In 1918 a patient was injured by vapors of dichlorethylsulphide which penetrated through a defective gas mask, causing obstinate conjunctivitis and photophobia. In 1924 and 1935 he had relapses. In April, 1939, corneal ulcers presented with calcareous incrustations, atrophic conjunctiva, and varicosities. Removal of the incrustations did not improve the condition and the irritation increased. Finally a part of the atrophic conjunctiva was replaced by a flap of mucous membrane from the lip with good success.

C. Zimmermann.

17

SYSTEMIC DISEASES AND PARASITES

Argañaraz, Raúl. **Considerations on allergy.** Arch. de Oft. de Buenos Aires, 1939, v. 14, April, p. 293.

Notes on basic concept of allergy, including general manifestations, modes of sensitization, and other factors.

Edward P. Burch.

Csillag, Franz. **Subretinal cysticercus and cysticercosis imitating symptoms of brain tumor.** Klin. M. f. Augenh., 1940, v. 104, Feb., p. 231.

In a woman complaining of attacks of headache with vomiting the vitreous of the left eye was diffuse gray and showed an irregular bulging in the lower part. In the muscles of the limbs small nodules were felt under the skin, and roentgen examination showed destruction of the sella turcica. Blurring of the disc of the right eye and the general condition of the patient indicated increased cerebral pressure. The patient died after a year. The autopsy revealed a cysticercosis of the whole

body, including the brain, heart, and the muscles of the limbs.

C. Zimmermann.

Guerra, P. **The ocular changes in exanthematous typhus.** Minerva Med., 1940, v. 31, Jan. 28, pp. 83-85.

The conjunctival phenomena may be attributed to the acute febrile condition, the intense dilatation of the blood vessels being also perhaps connected with ureic toxemia. The corneal changes may depend upon circulatory phenomena similar to those found in the extremities, representing periarteritis and endarteritis. The fundus lesions probably depend upon meningeal disturbances.

W. H. Crisp.

King, M. J. **Ocular lesions of Boeck's sarcoid.** Trans. Amer. Ophth. Soc., 1939, v. 37, pp. 422-458.

Seven cases of Boeck's sarcoid with ocular manifestations are described and the literature on the subject is reviewed. The usual clinical manifestations of the disease are recounted as well as its pathology.

David O. Harrington.

Langdon, M. H. **Multiple myeloma with bilateral sixth-nerve paralysis and left retrobulbar neuritis.** Trans. Amer. Ophth. Soc., 1939, v. 37, pp. 223-228.

The clinical and pathologic picture of endothelial myeloma is briefly reviewed. An unusual case of multiple myeloma with involvement of the skull and the cranial nerves is reported.

David O. Harrington.

Lisch, K. **Ocular changes in polycythemia.** Klin. M. f. Augenh., 1940, v. 104, Feb., p. 157.

Following a severe headache a woman of 41 years suddenly developed a hemiparesis of her left arm; this was ascribed to a cerebral hemorrhage in consequence of polycythemia. After a few weeks she complained of severe burning in the right eye due to hyperemia of the conjunctiva, and exophthalmos subsequently developed. Nineteen days later the patient suddenly complained of diminution of vision in the right eye, and parts of the central retinal artery were found to have been converted into white bands. After four days these changes subsided leaving only a slight edema, but six months later the eye showed atrophy of the optic nerve with narrowed retinal arteries. The affection was attributed to spastic changes in the arteries. The patient was subjected to intensive treatment with roentgen rays which seemed to favorably influence the pathologic condition of the blood and the inclination to vascular spasms.

C. Zimmermann.

McMullen, W. H. **Ocular filariasis with a report of a case in which microfilariae Bancrofti were seen in the anterior chamber.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 587.

A discussion is given of the three species of filariae which are known to occur in adult or larval form in the human eye.

Filaria Bancrofti is carried by mosquitoes, including culex fatigans, stegomyia variegata, and anopheles costalis. In the patient described the filaria could be seen in the aqueous of each eye while the eye was quiet between attacks of uveitis.

Beulah Cushman.

Pergola, Alfredo. **Ocular complications of herpes zoster ophthalmicus.** Rassegna Ital. d'Ottal., 1939, v. 8, Nov.-Dec., p. 675.

Pergola discusses the various ocular complications of trigeminal herpes, and

reviews the literature of the subject. He then describes the case of a 55-year-old man in whom the first and second branches of the trigeminal nerve were involved. A few days after the appearance of vesicles, there developed paralysis of the levator, iridocyclitis, hyphemia, ophthalmoplegia totalis, and secondary glaucoma. The man had been a typographer for 44 years and the author suggests that lead carried through the blood stream had affected the gasserian ganglion and then had traveled upward to produce a lesion of the mesencephalon.

Eugene M. Blake.

Shumway, E. A. **Final ocular result in a case of anterior poliomyeloencephalitis twenty-seven years after the acute attack.** Trans. Amer. Ophth. Soc., 1939, v. 37, pp. 179-184.

The case was followed for 27 years. By means of vertical prisms, the patient was kept free from diplopia. The detailed account includes particulars of general as well as ocular conditions.

David O. Harrington.

Woods, A. C., Burky, E. L., and Friedenwald, J. S. **Experimental studies of ocular tuberculosis. 4. The relation of ocular sensitivity, cutaneous sensitivity, and ocular activity in the immune-allergic rabbit.** Arch. of Ophth., 1940, v. 23, Feb., pp. 351-362; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1939, 90th mtg, p. 331.

Immune-allergic rabbits secondarily infected in one eye with tubercle bacilli were found to require a greater dose of bacilli to produce satisfactory ocular tuberculosis than normal rabbits. The growth of the bacilli and the spread of the lesions are inhibited, and the development and increase of ocular sensitivity are less in the immune-allergic rabbit. Active ocular tuberculosis does not influence cutaneous reactivity to purified protein derivative and the determination of the cutaneous sensitivity gives no indication of the degree of ocular sensitivity. While in the early stages the tuberculous inflammation roughly parallels the degree of ocular sensitivity, in the later stages this is not true. The tuberculous inflammation may subside while a fair degree of ocular sensitivity remains. Thereafter ocular sensitivity declines, but there may be a definite lag in the subsidence of ocular sensitivity after apparent healing. J. Hewitt Judd.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Agramonte, L. S. **Concerning vision.** Rev. Cubana de Oto-Neuro-Oft., 1939, v. 8, March-April, p. 33.

Thirty-six ophthalmic aphorisms.

Alvaro, M. E. **Forty-third meeting of the American Academy of Ophthalmology and Otolaryngology.** Rev. Oto-Neuro-Oft., 1939, v. 14, April, p. 93.

Description of the program of the meeting held in October, 1938, at Washington, D.C. Edward P. Burch.

Bickerton, H. R. **Blind certification.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 1, p. 447.

Certifications of blindness are analyzed. Of those certified as blind from cataract many should have had the advantages of surgery, and in others the blindness was the result of general diseases, such as diabetes, senility, or heart disease, rather than cataract. The author concludes that it is unjust to applicants and to taxpayers for the general practitioner to do blind-certification work. Beulah Cushman.

Cruz, F. Z. **Incidence of ophthalmia neonatorum in the Philippines.** Jour.

Philippine Islands Med. Assoc., 1939, v. 19, Sept., p. 555.

The writer states that there are no complete statistics showing the incidence of ophthalmia neonatorum in the Philippines, but he has obtained all available data on this disease for a period of two years (1937 and 1938) from the different health agencies in the archipelago. The 147 cases studied averaged 5.5 days of age, none being over 14 days. No fatality or probable loss of vision is recorded among these cases. Control legislation is cited and mention is made of the instillation of 20-percent argyrol solution into the eyes of babies immediately after birth as the most commonly used prophylactic measure. F. M. Crage.

Grosz, Emile de. **The surgery of the eye in Hungary.** Glasgow Med. Jour., 1939, v. 132, p. 137.

A brief history of the development of ophthalmology in Hungary is given. The author names the types of operation performed at the University Eye Hospital at Budapest by himself and his assistants. The indications and results obtained in the various intraocular and extraocular procedures are noted. Intracapsular cataract extraction is especially discussed. Basal excision and incision of the iris as practiced by Elschnig are said not to eliminate postoperative prolapse of the iris. Cyclodialysis is considered less risky but not as permanent as trephine or iridectomy in glaucoma. It is felt that late infection after trephine is overestimated.
F. M. Crage.

Guzmán, A. D. **Visual hygiene.** Rev. Cubana de Oto-Neuro-Oft., 1939, v. 8, March-April, p. 27.

An article on the hygiene of vision with particular reference to the conditions under which children study at school. The development of myopia in the school-age child because of poor conditions of visual hygiene is stressed.
Edward P. Burch.

Lawson, Arnold. **The latest principles for applying tinted glass to industrial and other purposes.** Trans. Ophth. Soc. United Kingdom, 1939, v. 59, pt. 2, p. 683. (See Section 3, Physiologic Optics, refraction, and color vision.)

Le Crom-Hubert. **A simple method of avoiding confusion between colored signals by color-blind motorists.** Bull. Soc. d'Opht. de Paris, 1938, Feb., p. 65.

The author proposes to place a narrow band of green glass across the upper part of the windshields of automobiles driven by color-blind individuals. The color is adjusted to screen out most of the red rays and transmit most of the green rays. The affected individual would thus be able to distinguish between the colors by their relative brightness when viewed through the screen. George A. Filmer.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Payne, B. F. **Coloboma of the optic nerve in the human embryo.** Trans. Amer. Ophth. Soc., 1939, v. 37, pp. 458-464.

This is the first typical coloboma of the optic nerve in a human embryo to be reported in the literature. Retinal overgrowth in three normal embryos is anatomically described. Theories of development of atypical colobomas are outlined. A clinical case of partial coloboma is described.
David O. Harrington.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
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News items should reach the Editor by the twelfth of the month

Deaths

Dr. John Peter Miller, Grand Forks, North Dakota, died April 18, 1940, aged 60 years.

Dr. Paul Stearns Mertins, Montgomery, Alabama, died April 10, 1940, aged 63 years.

Dr. L. Leo Doane, Highland Park, Illinois, died April 11, 1940, aged 83 years.

Dr. Forest F. Slyfield, Duluth, Minnesota, died suddenly May 2, 1940. He was born in Wisconsin on September 2, 1886. He served his internship at St. Luke's Hospital, Chicago. After five years of general practice he studied under Dr. Casey Wood and Dr. Frank Alport and later in New York City. In addition to his busy industrial practice Dr. Slyfield was Medical Director of the Boy Scouts of Duluth and was a member of the Executive Board of the North Star Council of the Boy Scouts of America. He was active in Masonic work and was a past Commander of the Knights Templar of Duluth.

Miscellaneous

The Leslie Dana Gold Medal, awarded annually for outstanding achievements in the prevention of blindness and the conservation of vision, was presented this year to Mr. John M. Glenn, of New York City, honorary vice-president of the National Society for the Prevention of Blindness.

Mr. Glenn was selected for this honor by the Saint Louis Society for the Blind, through which the medal is offered by Mr. Leslie Dana of Saint Louis. This highly prized token of recognition in the field of public health is given each year upon the recommendation of the Association for Research in Ophthalmology.

Identified with the organized movement for the protection of eyesight in America since its beginning in 1908, Mr. Glenn served as a member of the board of directors of the National Society for the Prevention of Blindness for three decades, and became honorary vice-president in 1938. He aided materially in securing adequate funds during the early years of the society's history, and has given active assistance in guiding the organization's policies throughout the years.

Mr. Glenn, who is 81 years old, was born in Baltimore. He received an M.A. degree from the Washington and Lee University in 1879; was a student at Johns Hopkins University from 1879 to 1880; received an LL.B. degree from the University of Maryland in 1882; received an honorary M.A. from Johns Hopkins in 1902 and an honorary LL.D. from Washington and Lee University in 1907. He was admitted to the bar in 1882.

The staff of the Illinois Eye and Ear Infirmary in Chicago announces a six-month course for orthoptic technicians, to start on October 1, 1940. The work will follow closely the recommendations of Orthoptic Council. Applications should be accompanied by a letter of recommendation from an ophthalmologist and be sent to the Dean of Instruction, The Illinois Eye and Ear Infirmary, 904 West Adams Street, Chicago.

Societies

The seventy-first meeting of the Brooklyn Ophthalmological Society was held in the auditorium of the Kings County Medical Society Building, February 15, 1940. Dr. E. Clifford Place, the president, presided. The scientific program comprised two presentations: Glaucoma capsulare by Dr. Harry S. Gradle and Correction of refractive errors in children by Dr. Alfred Cowan.

The seventy-second meeting of the Brooklyn Ophthalmological Society was held on April 18, 1940. The scientific program was as follows:

1. On the beginnings of local anesthesia, by Dr. Carl Koller. He told of the days he spent as an intern, 1881 to 1884, during which time he was interested in research. With this background he was later prepared to make proper investigations when the idea of cocaine anesthesia first entered his mind. He and Dr. Siegmund Freud were interested together in helping a friend break his morphine habit and were substituting cocaine. They studied some of the effects of cocaine on themselves and the numbness of his tongue suggested the use of cocaine for eye anesthesia. Dr. Koller at once tried cocaine in animal eyes and later on himself and then on patients.

2. Spectacles, old and new, by Mr. Scott Sterling; 3. Results of the correction of aniseikonia, by Dr. Conrad Berens; 4. Exhibit of old spectacles, frames, and cases, by Dr. Ira W. Mensher; 5. The history of spectacles, by Dr. Ralph I. Lloyd.

The eighteenth annual dinner of the Brooklyn Ophthalmological Society was held at the Hotel Bossert, May 16, 1940. Dr. E. Clifford Place, the president of the society, presided. Seventy-seven members and guests were present.

During the course of the dinner, a set of four golf clubs was presented to Dr. Place by Henry Mitchell Smith on behalf of the members of the society while a sundial was presented to Dr. Joseph Golding by Dr. Ralph I. Lloyd on behalf of the society. Both Dr. Place and Dr. Golding expressed their warm appreciation of the gifts. The following officers were elected: president, Dr. Maurice Wieselthier; vice-president, Dr. Walter Moehle; secretary-treasurer, Dr. Harold Schilback; associate secretary-treasurer, Dr. Irving Jacobs.

The Oxford Ophthalmological Congress will convene at Oxford on July 4 to 6, 1940. The Doyne Memorial address will be delivered by Professor le Gros Clark, his subject being: Emergencies and complications of the operation for cataract.

The Ophthalmological Society of the United Kingdom convened on April 25th and 26th, with Professor A. J. Ballantyne opening a discussion on The choice of operation for glaucoma.

The Guild of Prescription Opticians of America, Inc., held its fifteenth annual convention in Philadelphia, on May 19, 20, 21, 22, 1940.

Personals

Dr. Daniel B. Kirby was appointed professor of ophthalmology, College of Medicine, New York University, and director of the Eye Service of Bellevue Hospital, on June 1, 1940. He succeeds Dr. Webb W. Weeks in the posts formerly held by Drs. J. E. Weeks and J. M. Wheeler.

St. Bonaventure's College, Alleghany, New York, at the annual commencement on June 4, 1940, conferred the honorary degree of Doctor of Laws on Dr. Arthur J. Bedell, of Albany, New York.